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MARCH 1985 BRITAIN'S BIGGEST COMPUTER MAGAZINE Vol. 5 No. 3

ROBOTS
Take me to your micro

Spectrum Securifile, Speed Basic and Terrapin

Superprite CBM-64 and Amstrad Artist

Oric Creep Castle and Dragon Wordprof

BBC Bells and Disc Overlays



YOUR COMPUTER Contents

MARCH 1985


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25 LETTERS: Save the Dragon, magic Poke prolongs knights.

29 FIRST BYTES: What is CP/M and how do micros store data?

33 COMPUTER CLUB: Paul Bond has a harrowing experience.

35 HARDWARE HIT LIST: Penman and the Oric modem.

37 SOFTWARE SHORTLIST: Latest commercial software releases — wizards versus lizards, choppers versus brick walls, coal-stealing moles versus prison warders.

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46 CBM-64 SPACE JUNK: Nalin Sharma's mammoth space game.

51 WIN A £1100 ROBOT COMPETITION: Last year we got you to design your dream or nightmare micro — this year create your own Iron Man. Be a Frankenstein.

52 RULE OF THE ROBOTS — TAKE ME TO YOUR MICRO: Investigates the current market for cheap domestic robots linked to home computers.

57 ZX-81 MAD JUMP: Fredrik Ivarson's conveyor belt to hell. Don't bork your head or fall through the gaps in the rollercoaster of micro fun.

59 SPECTRUM TERRAPIN: High resolution movement, colour, sound, graphics — Ian Collier sets out to save terrorised terrapins without turning turtle.

65 BBC AND ELECTRON BELLS: It's for yoo-hoo, Esmeralda. Quasimodo has a chip on his shoulder but Bryan Lewis has a great game for both Electron and BBC computers.

71 SUPERSPRITE CBM-64: Graham Barbour's program runs independently of Basic and provides all the sprite editing facilities you could possibly want.

77 ATMOS CREEP CASTLE: Grotesque graphics, awesome sound. You won't tire of Miles Dunlop's new game — twelve screens and stacks of platforms.

82 DRAGON WORDPROF: Full auto repeat on keys, stores four separate 6144-character files, and fits into only 2K. Simon Tully's word processor for the D-32.

85 ALL ABOUT ADE — AND BCPL: John Dawson initiates you into the rites of two high-level languages.

90 AMSTRAD ARTISTS ONLY: Wai Tsang splashes out on a drawing program for the Amstrad. Offers line drawing, circle plotting and airbrush facilities.

92 SPEEDING UP BASIC: Richard Taylor lashes out at slow Spectrum Basic. Totally user transparent and will work with all Spectrum Basic programs.

97 TELSOFT: Every month at least two of the main programs published in *Your Computer* is available down your telephone line. This month it's BBC Bells and ZX Securifile.

98 EXTENDED VIC BASIC: David Redmond teaches the Vic-20 more words and gives demonstrations.

102 SPECTRUM SECURIFILE: A flexible machine-code data handling program will be developed illustrating many of the points discussed in this article by Jon Ellis.

106 BBC DISC OVERLAY: P. Andrews solves a space dilemma.

110 INVISIBLE ZX-81 TOOLKIT: Stuart Clarke peps up the ZX-81.

114 QL TUTOR: More 68008 assembly language for the Sinclair QL, courtesy of Phil Holliday — not forgetting a brief introduction to QDOS.

117 FALL GUY COMPETITION WINNERS: A *Your Computer* reader goes to Hollywood. Don't forget about this month's great robot competition, either.

119 RESPONSE FRAME: Tim Hartnell replies to readers' queries.

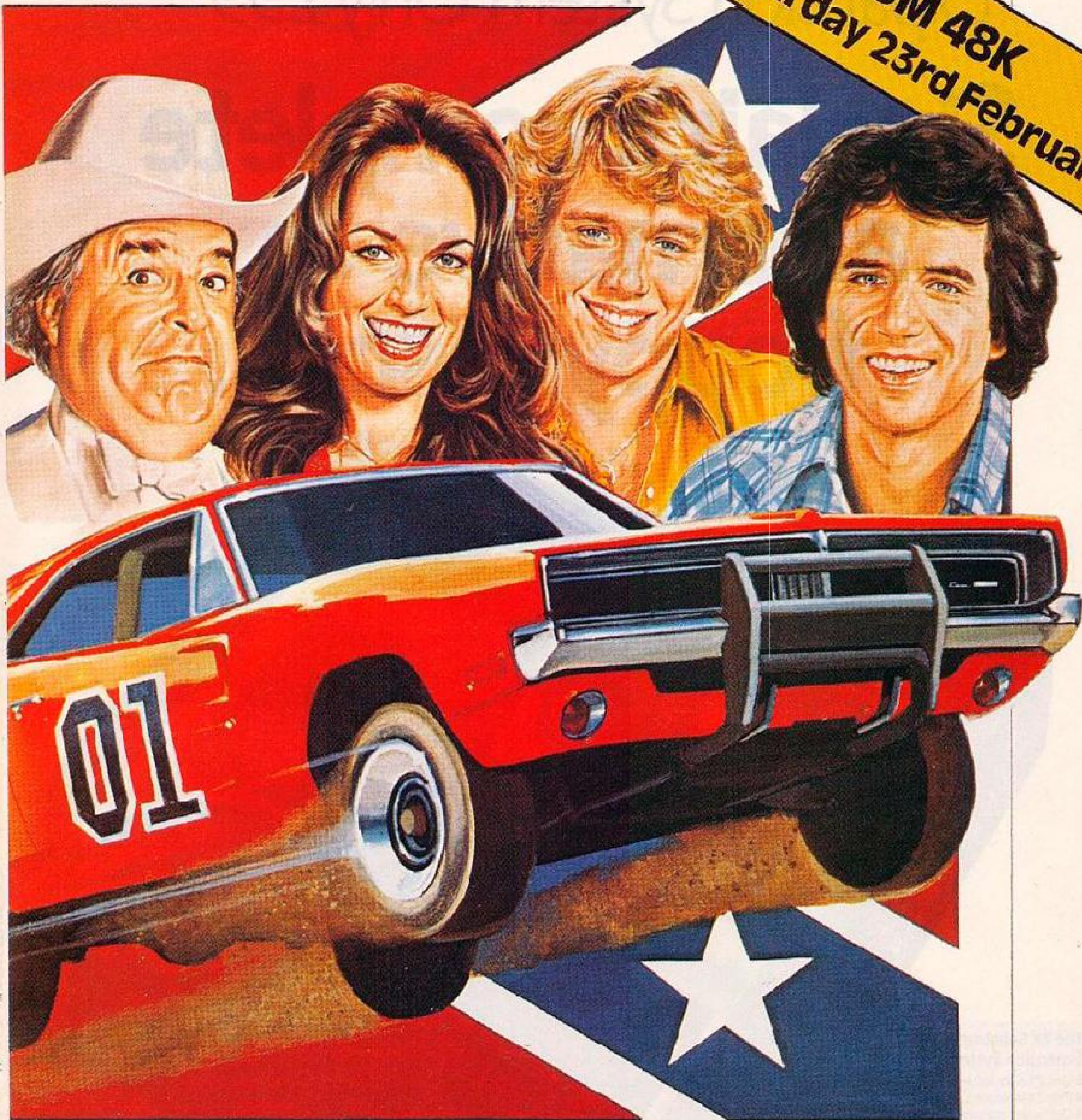
121 SOFTWARE FILE: Ten pages of software for most micros.

130 INDEX: Continued from last month.

146 DATEBASE: Paul Bond rounds up micro events.



That old villain sheriff Boss Hogg is up to his tricks again. The Dukes still owe him $5,000 which they borrowed to buy some new farm machinery. Sheriff Hogg wants the money repaid, and he's told the Dukes that unless they pay up in 72 hours he'll seize the General Lee as collateral. Bo and Luke have come up with the idea of entering the annual Hazzard County Cross Country Road Race – First prize $5,000, which starts tomorrow. Normally the Duke boys would have a good chance of winning but with the entire Hazzard County Police Force and Boss Hogg revving up to stop them, now they're not so sure.



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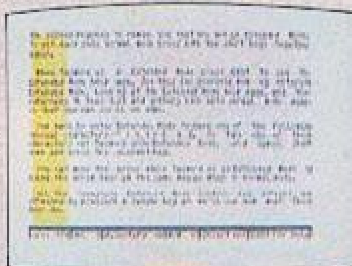
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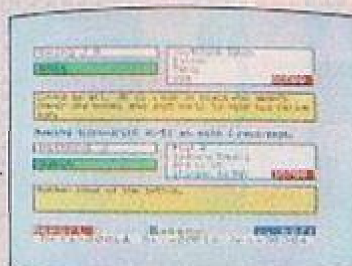
There's never before been an easier, more enjoyable, way into games design.
Written by Quicksilva Ltd.
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Address lists ... personel files ... stock inventories ... stamp or album collections ... club records ... recipes ... if you can file it, you can Masterfile it!

Masterfile is a menu-driven filing and retrieval system of immense power. Display formats are user-defined, so the range of applications is enormous.
Written by Campbell Systems Ltd.
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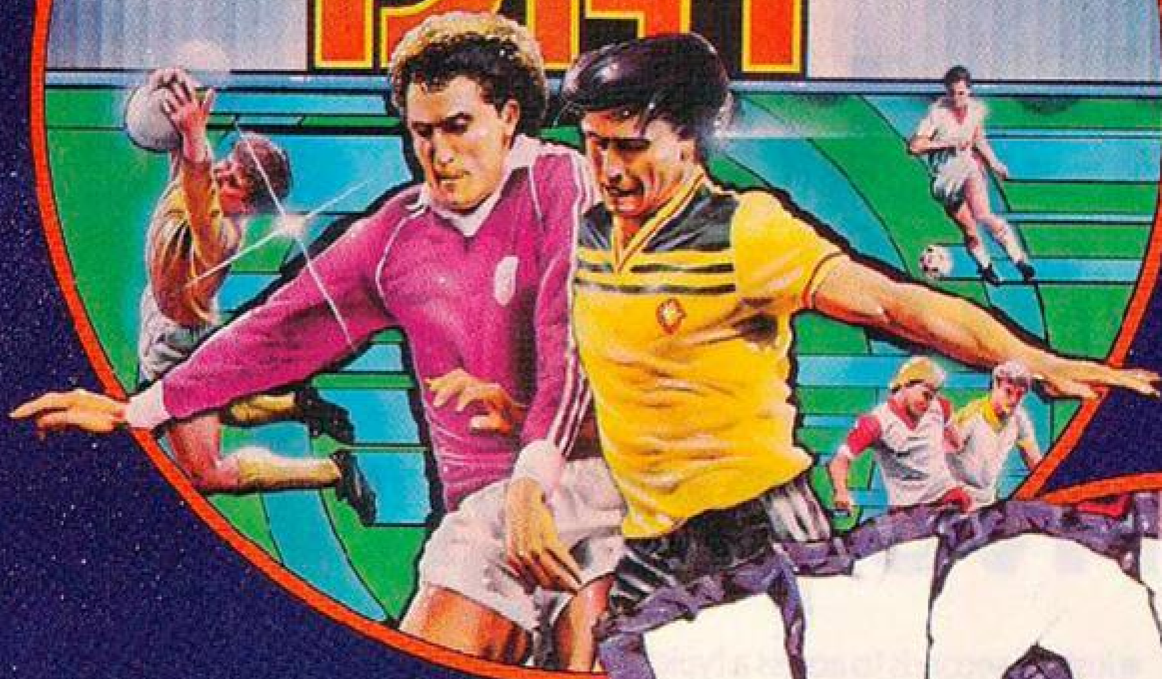
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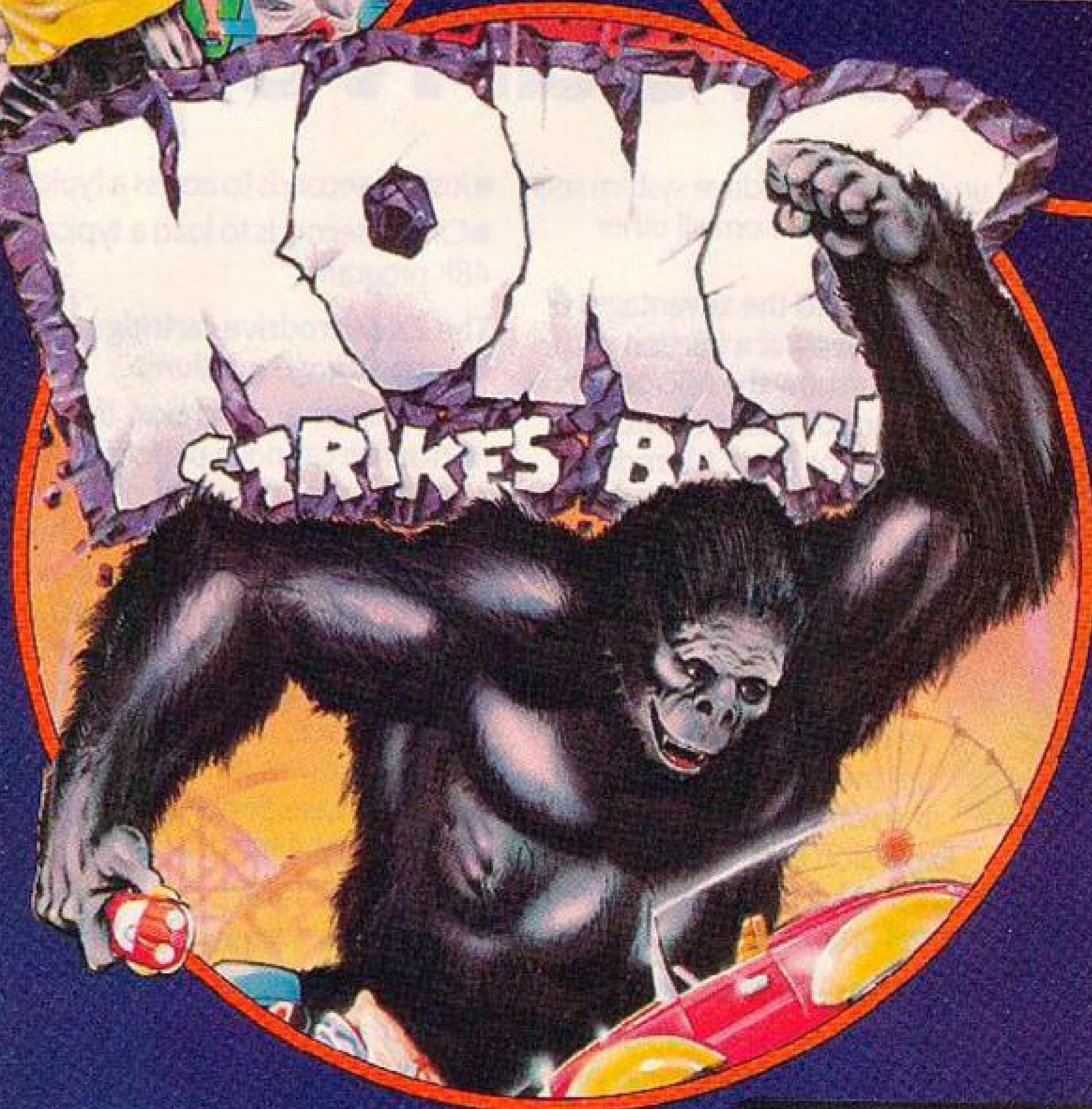


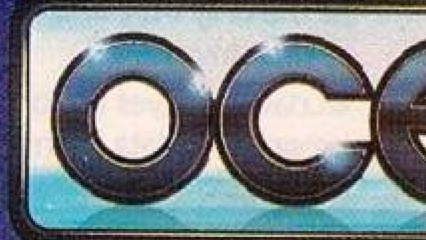
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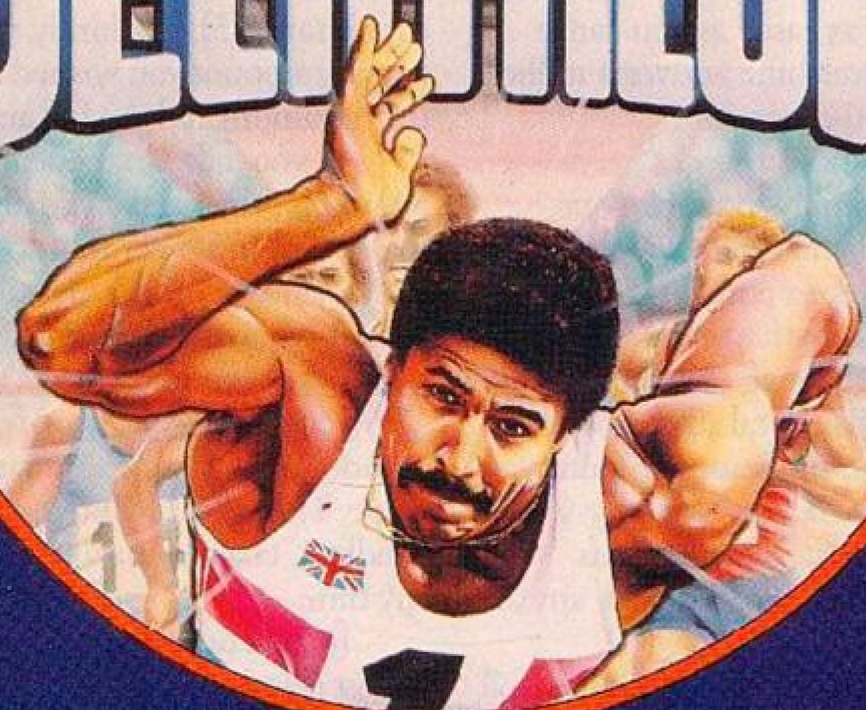




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House Name

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County

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Country

2. Your personal details and telephone number.

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Are you Single ☐ Married ☐ No. of dependant children

Home Telephone No. (including STD code)

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3. Your employment

Employer

Business Address

Present position

Years with present employer Annual Income £

Self employed. No ☐ Yes ☐ If yes, how long years

Occupation of Spouse

First Names of Spouse

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Years at this Address Are you Owner ☐ Tenant Furnished ☐ Tenant Unfurnished ☐ With Parents ☐

If house is mortgaged give name of Lender

If at present address less than three years give former address

for years

5. Your bank.

Bank Sorting Code

Branch Address (in full)

Type of Account Cheque ☐ (held for years) Deposit ☐ Loan ☐

6. Other cards held.

Access ☐ American Express ☐ Diners Club ☐ Cheque Guarantee ☐

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If you wish us to issue a second card on your account for use by another person (eg. your spouse) ask that person to complete this section.

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(b) A handling charge of 1½% on the amount of any cash advance will be debited to the card account.

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10. The Bank shall not be liable in any way if the card is not honoured by a supplier.

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(b) the cardholder will sign the cheque in the presence of the payee;
(c) the cardholder will ensure that the payee writes the card number on the reverse of the cheque;
(d) the cardholder will limit such use to a cheque for an amount not exceeding £50 and will not issue more than one such guaranteed cheque in respect of any one transaction;
(e) the cardholder will not issue a cheque against the guarantee in excess of the funds available on his or her current account except with the prior consent of the relevant Designated Bank;
(f) the cardholder will not for any reason countermand payment of any cheque so guaranteed;
(g) the relevant Designated Bank may debit any such cheque to the cardholder's current account without reference to the cardholder and even although the cheque may bear technical irregularities; and
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QL NEWS

News from the world of Sinclair QL computing.



One year old... and look how we've grown!

When we launched the QL last year, we knew we were starting a revolution.

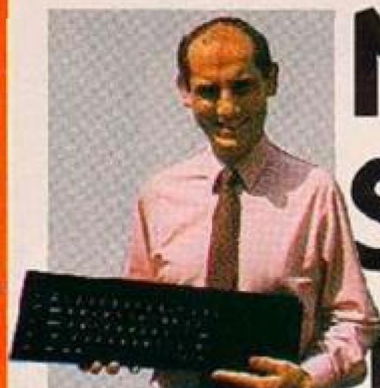
For the first time, the serious computer hobbyist could afford the same power and performance as the professional computer user.

A year later, and the QL is more than a unique computer, it's the heart of a unique system.

And the next 12 months promise even more for QL owners... new software options, extra storage devices, printers, monitors...

Read on, and see how far we've come, and how much further we're going!

Nº1



NIGEL SEARLE

Now it's the quantum leap for QL software and peripherals

Without doubt, the QL was the computer innovation of 1984. Launched to outstanding reviews, it soon gathered thousands of happy owners, and recognition from people like ICL, who have incorporated QL technology and its Microdrives into the new One Per Desk.

The quickest glance at the QL's specification shows what the fuss was all about... 128K RAM, 32-bit processor architecture, 200K built-in mass storage, bundled software. They're features that would normally cost you three or four times as much!

But that's only half the story, because the QL is now the heart of a computer system, with a growing library of software...

As you'll see from these pages, 1985 is the year of the quantum leap for software and peripherals. Already there are no less than five QL languages together with special programs for software developers, a world-beating chess game... and much more on the way!

On the hardware side, there's a special QL monitor to make the most of that high-resolution 512 x 256 pixel display. There are memory expansion boards, Winchester disk drives, printers, and low-cost Microdrive cartridges.

In fact, there's so much going on, we'll be running these regular Newsletters just to keep you in touch!

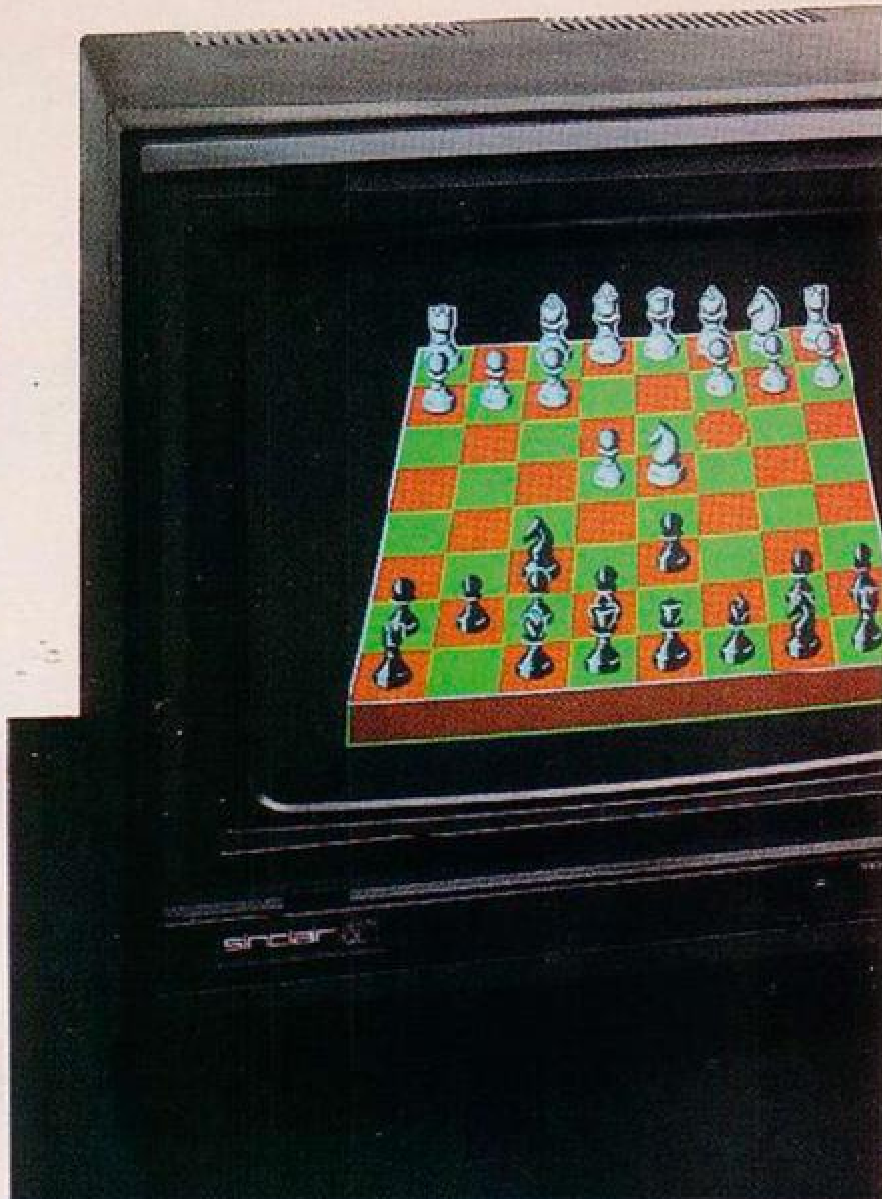
If you already own a QL, the next few pages will give you a taste of the exciting year ahead.

And if you don't . . . take a look at what you're missing. It should be all the persuasion you need!

Now read on...the quantum leap into serious computing starts here.

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Limited.



From sophisticated business packages to superb animated games... QL software makes the most of the computer's extraordinary specification.

New QL Software

Utilities, languages, games and business packages...with more on the way!

Two things are now certain about QL software. First, there's going to be plenty of it. And second, it's going to set completely new standards for microcomputers...

At the moment, there are well over 100 software programs in development. And the first software releases, shown here, demonstrate how exceptional the best QL software will be.

The QL already has five languages, superb programs for software developers, a top quality accounting package and in QL Chess it has its first game.

QLUB: 10,000 members and growing!

QLUB is the special Users Bureau for Sinclair QL owners. There are now well over 10,000 QLUB members, and membership is growing all the time.

For their annual subscription of £35, QLUB members are enjoying a whole range of information and advisory services, exclusive offers and special discounts.

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL Programs, and news of how other people are using the QL. QLUB members also receive a range of special discounts, with savings of at least 20% on selected software products.

Current special offers include:
QL Chess for £14.95
QL Toolkit for £19.95
QL Assembler for £31.95
QL Cash Trader for £54.95
Special subscription rates for Personal Computer News and QL User.





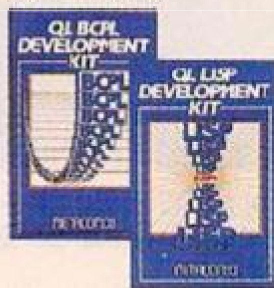
The multilingual Sinclair QL

BCPL – a forerunner of C, BCPL has been described as a systems programmer's delight. In the words of QL User, this compiler is a 'brilliant compromise between a high-level language and a low-level systems language'. Whilst not for beginners, this is an essential buy for anyone with a good knowledge of systems programming. Complete with manual.

Available from
Metacomco – £59.95.
Tel: 0272 428781.

LISP – already well-known for its artificial intelligence applications, LISP is a powerful and versatile language. This is a sophisticated implementation of LISP, by one of its leading exponents, Dr Arthur Norman. This package features full QL graphics, and a full manual is supplied.

Available from
Metacomco – £59.95.
Tel: 0272 428781.



Pascal – probably the most popular high-level language of all. Pascal is particularly well-suited to structured programming, sophisticated data manipulation and algorithmic problems. Pascal interpreter complete with 87-page manual.

Available from
Computer One – £39.95.
Tel: 0223 862616.



Forth – this 'new generation' language is proving both popular and easy to learn. The program provides a full implementation of the latest Forth 83 standard with graphics and sound extension.

Available from
Computer One – £29.95.
Tel: 0223 862616.

APL – the compact mathematics-based interpreted language designed for scientists and mathematicians.

APL keyword interpreter complete with manual.

Available from
MicroAPL – £99.95.
Tel: 01-622 0395.

Psion trouble-shooting service

All QLUB members can obtain special assistance from Psion on using the QL Quill, Abacus, Archive and Easel programs supplied with the computer. Psion will normally answer any queries within 48 hours.

Programmer's packs

QL Assembler – two programs operating in tandem. The first is a full-screen editor for creating and altering program files. The second, a Motorola-format compatible 68000 assembler which converts source files written in M68000 assembly language into machine code files which can run on the QL.

Both assembler and editor are written in machine code and can be multi-tasked with SuperBASIC, so you can switch between editor, assembler and SuperBASIC instantly.

Written by GST Computer Systems – £39.95.*

QL Toolkit – a programmer's toolkit with over 70 programs and extensions to SuperBASIC. Most are linked to SuperBASIC initially and can then be used from commands or from within a program. Enhancements include printer spooling (print a file while running a SuperBASIC program); improved file access (with full random input/output command); job control (allows management of multi-tasking programs including the ability to display, alter priorities, and delete jobs from the QL); and SuperBASIC screen editor.

Written by Q Jump – £24.95.*

World-beating chess!

QL Chess – fresh from its victory at the World Microcomputer Chess Championship. This program sets a completely new standard for games software.

There's a high resolution display, animated 3-D graphics, and 28 levels of play from novice to champion. Features include an openings book of nearly 4000 moves, HINT and TAKEBACK functions that help you learn from your mistakes, and the option to play a human opponent or the computer.

Written by Psion – £19.95.*

Software at work

QL Touch 'n' Go – a unique approach to learning touch-typing skills. The program is designed to give you mastery of the standard QWERTY keyboard in just 24 hours. With practice, you should soon reach 40 words per minute, with over 95% accuracy.

Written by Harcourt – £24.95.*

QL Cash Trader – a unique computerised book-keeping system for small businesses. The program provides a complete course in the principles of accountancy, and goes on to become an essential aid in the day-to-day running of a business. Complete with comprehensive manual.

Written by Accountancy Software of Torquay – £69.95.*

***This title is available from Sinclair Research on 0276 686100, and selected Sinclair stockists nationwide.**

New QL Hardware
An industry is born

From the moment of its launch, the revolutionary QL attracted massive interest from all quarters.

In one area, the interest quickly turned to action, as high-tech hardware manufacturers realised the immense potential of the QL for vast expansion, for system development and for widespread networking. Already the list of peripherals for the QL is very exciting – and lengthening by the day!

Here, we've covered many of the latest, most important developments.

As more appear, be sure to keep in touch with QL News!

The dedicated Sinclair Vision QL monitor

Once you see the incredible graphics capabilities of the QL you may decide an ordinary TV just can't do them justice.

If that's the case, a high-resolution monitor is needed. (And if you're creating presentation-quality charts, for example, it's quite essential.)

The new Vision QL monitor is specially designed for the computer by Kaga Electronics, with full support from Sinclair Research.

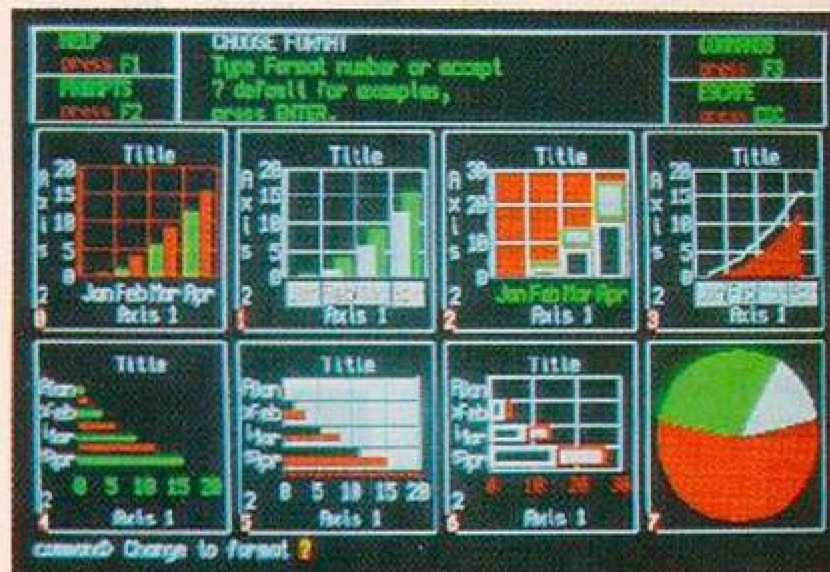
So it exploits the QL's maximum 512 x 256 pixel resolution to the full, with a pin-sharp 85 column display.

It's also specially styled to suit the QL – in looks, and in use. There's a 12" non-glare tube, and etched screen to diffuse reflections.

So the display is bright, sharp, *much* easier to look at . . . and invaluable for those late-night programming sessions.

And like the QL, the Vision monitor is designed with space in mind: it has a compact footprint of just 12½" by 15" – no more than a typical portable typewriter.

It's available from MBS Data Efficiency on 0442 60155 and selected Sinclair stockists.



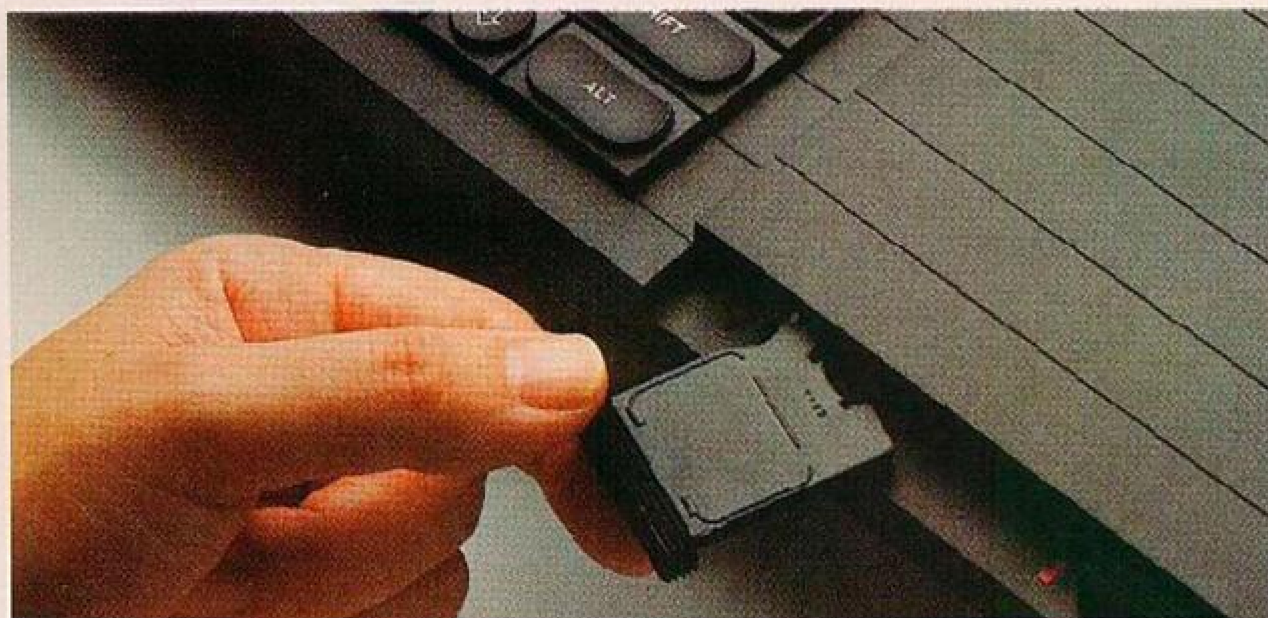
The QLs superb graphics capabilities – as demonstrated by the Sinclair Vision QL monitor.

Microdrive cartridges. Now only £1.99!

Microdrive cartridges are the QL's own unique storage media. Each stores up to 100K of information, on a cartridge no bigger than a matchbox!

Over 500000 cartridges are now being used throughout Britain. And QL Microdrives themselves are standard equipment on the new ICL One Per Desk micro.

Now there's more good news for QL enthusiasts: from February 1, the cost of QL Microdrive cartridges are down from £4.95 to £1.99 each!



Sinclair Microdrive cartridges – up to 100K of programs and data on a medium so compact you can pop it into your pocket.

Powerful hard-disk system

For the QL business user, the new Firefly QL Winchester disk will boost the QL's power in one huge leap.

Designed by Quest, it uses CP/M and offers all the benefits of Winchester technology: fast access, reliability, compact size and quiet operation.

With 7.5 Mb storage, the Quest Firefly is ideal for large databases such as stock or customer lists. And at under £1,200, it represents exceptional value for money.

The Firefly will be available very shortly from Quest on 04215 66488.



Winchester hard disk drives supplement your QLs built-in mass storage.

Interface options

The QL comes complete with two built-in RS-232C interfaces.

In addition, interfaces for Centronics printers are widely available from manufacturers such as CST, Miracle Systems and Sigma Research . . . with prices from only £35.

And that's just the beginning. For attaching scientific and laboratory instruments to the QL CST even offer an IEEE-488 interface, which can handle up to 16 connected devices simultaneously!



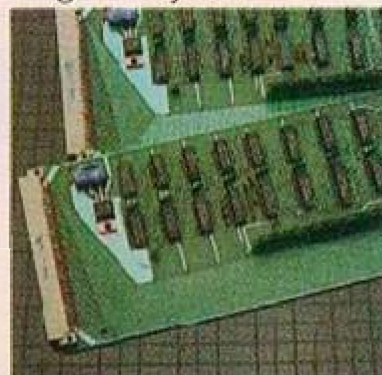
A Centronics interface slips discreetly into place.

Expansion boards for up to 4 times more memory!

Also from Quest, a simple and inexpensive way to expand the QL's RAM: with memory expansion boards.

These compact units connect to the standard QL expansion port, using the QL's internal power source or, for larger boards, an external power source.

The units range from 64K and 128K RAM boards to massively powerful 256K and 512K RAM boards, so there's something for every user.



Compact expansion boards

Prices start at £117, and the 512K board is a very cost-effective investment at just £537.

With affordable memory like this, the QL is more than a match for any other micro under £2,000!

The spec behind the spectacle

CPU – Central Processing Unit
Fast, powerful Motorola 68008 chip. A second processor, an Intel 8049, controls the keyboard, generates the sound, and acts as an RS-232C receiver.

RAM
128K. Now expandable to 640K.

ROM
48K.

Operating system
Qdos – revolutionary single-user, multi-tasking, windowing operating system.

Storage
Twin built-in QL Microdrives. Up to 100K storage each – transfer rate, up to 15K per second.

Keyboard
Full moving 65-key QWERTY, five function keys, four cursor keys.

Language
Sinclair structured SuperBASIC.

Application software
QL Quill – word processor
QL Abacus – spreadsheet
QL Easel – graphics
QL Archive – database
All four packages supplied with the QL.

Interfaces
Two serial RS-232C interfaces, Microdrive expansion port (up to 6 may be added), ROM cartridge port, local area network, 2 joystick ports, RGB monitor and TV output.

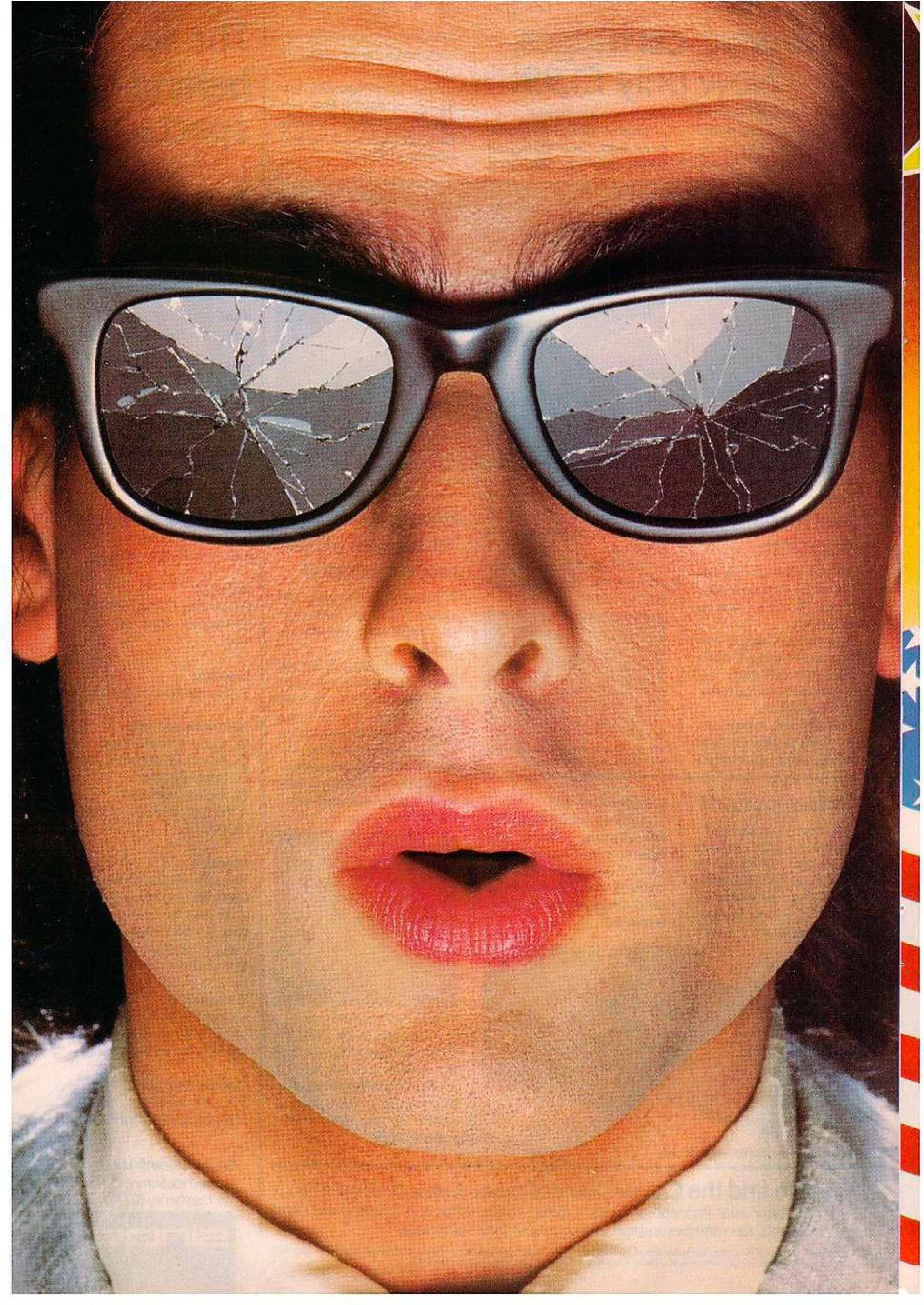
Text screen
Various modes – up to 85 columns by 25 rows on monitor. On TV, up to 60 columns.

Graphics resolution
512 x 256 pixels (four colour), 256 x 256 pixels (eight colour).

Where to find the QL. The Sinclair QL is available at selected branches of Dixons, W H Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

Sinclair Research Ltd
Camberley, Surrey, GU15 3BR.
Tel: Camberley (0276) 686100.

sinclair



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DOUBTS FROM ACORNS GROW

THE FIRST SIGNS for Acorn's employees that Cambridge wasn't all growth and glittering prizes was when they opened the *Daily Mail* to find an exclusive interview with their boss Chris Curry. There, among the revelations about Curry's steamy sex life, fast cars and million-pound mansion was the first mention of redundancies.

Meanwhile, next door but one to Acorn's customer service department, the familiar sound of gently bursting bubbles could be heard as Oric sank beneath the waves.

Still within the city limits a surprisingly ruffled Sir Clive Sinclair launched an unprovoked attack on Atari's QL-bashing ST computers — claiming they were a figment of Jack Tramiel's imagination. Wishful thinking perhaps, given the QL's disappointing sales of 50,000 in a year which celebrated the production of the five-millionth Sinclair-designed micro.

Could the curtains be closing on the stars of the great British micro industry? So far 1985 has been a bad year for everybody, but don't expect to see Sir Clive trading in his Porsche for a C-5 quite yet.

Sinclair dominates the U.K. market as much today as he did in 1981. But gone are the innovations. Even the 1982 model of Clive Sinclair wouldn't have been content with reboxing an existing machine. However good the Spectrum and despite his commitment to the 68000, Sinclair now runs the risk of becoming a one-computer company. Yet whereas that could be a problem in the making, Acorn has an immediate and deep crisis on its hands.

Its shares had fallen from a high of 193p last year to 23p before they were temporarily suspended on the Stock Exchange at 28p. Job cuts and a major reorganisation are part of paying the price for a poor Christmas and the disastrous foray into the U.S. market. The abortive American project may have cost the company as much as £12million and its recent £20,000 sales to Russia won't make much of a dent in that. Apart from that, the BBC Micro isn't getting any younger or appreciably cheaper, and Acorn may learn that producing business machines isn't really as easy as ABC.

But despite the pall of gloom, spending on home computers should rise sharply this year — up to a record £590million according to stockbrokers Wood Mackenzie. All the British companies have to do is go out and grab their share.

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Creasey controlling Douglas Herd's muscle movement.

PLEA FOR DISABLED

DR GRAHAM CREASEY'S plea for government funding to "give the disabled as much access to micros as people in schools" is being ignored by the Department of Health and Social Security.

"A micro can be at least as useful as a wheelchair", says Creasey who uses BBC Micros in his spinal unit at Edinburgh's Edenhall Hospital to improve his patients' manual dexterity while entertaining them.

He is also using micros for research into overcoming paralysis by controlling a series of electrical shocks to stimulate the muscles.

The Department of Trade and Industry already makes £2million a year available from its information technology budget for schemes including functional electronic stimulation and remote work units for the disabled.

But the DHSS says it has "no plans" to extend this sort of scheme to make micros available to all the disabled who might benefit.

Oric slides

ORIC HAS CRASHED, along with Prism which distributed the Atmos as well as the Spectrum and the Enterprise.

Sinclair and Enterprise have made alternative arrangements and the receivers are now looking for buyers for Oric and Prism. Barry Moncaster of Oric is suggesting a management buy-out and a multinational company is also believed to be interested.

Oric's normally talkative Marketing Consultant Bruce Everiss, who last year jumped before Imagine fell, will only say: "If I had a crystal ball I wouldn't be sitting here now". But he admits that French Atmos sales have collapsed in the last couple of months — "the Amstrad is the cult machine in France at the moment".

In Britain Oric has blamed Prism for failing to distribute properly.

PRICE FIGHTS
Sinclair and Acorn war



Commodore 128: Can CBM duck the price war?

MASSIVE PRICE CUTS, £30 off the Spectrum Plus and £70 off the Electron, have left the two old rivals squaring up to each other at the £130 mark. The first casualty of the war has been the "dead flesh" keyboard of the old Spectrum which has been buried without ceremony — only the click keyboard Plus will continue.

A Plus upgrade from Sinclair for an old Spectrum will cost £30 — or £20 for a kit which may put other keyboard makers out of business. Sinclair, who celebrated the manufacture of the five millionth Sinclair designed micro last month, has also taken on Commodore by chopping the price of Microdrive cartridges to £2 and claiming that the Microdrive saves and loads faster than the notoriously slow CBM 1541 disc drive.

But Commodore insists it will not cut prices yet. Nevertheless expect a cheaper 64 to make room for the CBM 128 this summer. This may leave the C-16 and Plus-4 in no-man's land.

TOUCHING BYEBYE TO THE KEYBOARD



Touchtech turns screen into paper.

TOUCHSCREENS are the ultimate in megapriced accessories for the executive who has everything — except the ability to communicate with a micro through its keyboard.

Now Microvitec is introducing the first budget-priced touch-screen, the Touchtech 501, which will allow the idea to be used to teach youngsters and the disabled. The 501 is a frame which fits over the screen of an ordinary 14in. Microvitec monitor.

The frame contains a grid of 12x16 infra red beams and sensors which are interrupted if a finger is placed on the screen. To improve resolution each beam fans out across three receptors which can distinguish it from other beams — this gives up to millimetre resolution in the centre of the screen.

Touchtech comes with a package of programs ranging from noughts and crosses to an artist program which allows you to paint on screen with your finger using a palette of six colours.

Open the box for C4's telly software

TELLY SOFTWARE allows you to download programs straight from your television. All you need is a home made light pen to stick over the pulsating cursor square which will be appearing in the corner of the screen on Channel 4's new show, 4 Computer Buffs, every Monday night.

Mike Thorne of University College, Cardiff has produced a design for a pen which you could make yourself for less than £5. All you need to do is plug it into your computer — Spectrum and BBC programs will be broadcast initially — and attach the light cell end to the screen where it can pick up the binary code flashing through.

Because the speed of data transmission is limited by the scan rate of the television screen it can take five minutes to load each kilobyte of program.

Quickdisc takes on Microdrives

QUICK DISCS for the Spectrum should be available from April for around £100. The Crescent Quickies use a spiral disc like a record which cannot be randomly accessed like the concentric discs which make most disc drives so fast. However according to the Crescent's makers, Servicon Dynamics, it is up to 20 times faster than a Microdrive.

Commodore on Telsoft

NEXT MONTH our Telsoft service kicks off the new Commodore 64 facility with the Space Junk program which starts in this issue.

So far 12,000 calls have been made to the free downloading service since Telsoft opened up with BBC and Spectrum programs from our December issue. Details of transmission times for your machine on (0206) 8068.

"THE GUY threatened to break my knees last week" jokes Bruce Everiss, well we hope it was a joke, after talking to Fireiron's new backer, scrap dealing millionaire Talbot Smith. Fireiron — home of Imagine refugees like Eugene Evans and Dave Lawson — has been plagued with practical jokes. One week six driving schools turned up to give one-time Lotus driver, now Beetle owner, Eugene his first driving lesson. For some reason frying pan to fire specialist Bruce — who moved from Imagine to Oric — fell under suspicion and was warned off by someone he describes as "Talbot Smith's gopher". Mild-mannered Bruce replied by sending him a bunch of daffodils which provoked the call from the breaker's yard.

EYE PATCH firmly in place and parrot on shoulder I ring up a Mr Ramsden of Pye Greave Farm near Barnsley who is offering Commodore 64 software for sale "all copied but excellent" from tape, disc or cartridge. His "brother" answers, Mr Ramsden is not there. I identify myself and say I will be back in touch. "Just you be careful", the "brother" replies, "or I'll be back in touch with you good and proper".

AMSTRAD BOSS Alan Sugar has been stirring rumours of new Amstrads — essentially different versions of the current machine with built-in drives and more memory — but Amstrad is keeping mum about the details. Amsoft's William Poel — the man who offered to eat an Amstrad in Trafalgar Square if the machine was late — says Sugar's guiding principle is "don't stimulate until you can consummate".

I KNOW sales of the QL could be better but does Sinclair have to go to the extreme of giving away hundreds of them to Strathclyde University in order to win the lukewarm tribute that very few have gone wrong?

ACORNSOFT'S David Johnson Davies will be surprised to hear himself described as "a cross between Ivan Lendl and an Egyptian mummy", particularly by someone who is about to launch his Elite on the CBM-64. Allegedly David "is good at tennis, gets as far as the semi-finals and then trips over the bandages". What can this mean?

Elsie Dee

ANGRY ATARI
Jack's boys hit back

ATARI IS ACCUSING Sinclair of sour grapes after his attacks on the new ST micros. "Sir Clive tried with the QL and it hasn't succeeded", says Atari's U.K. marketing director Robert Harding.

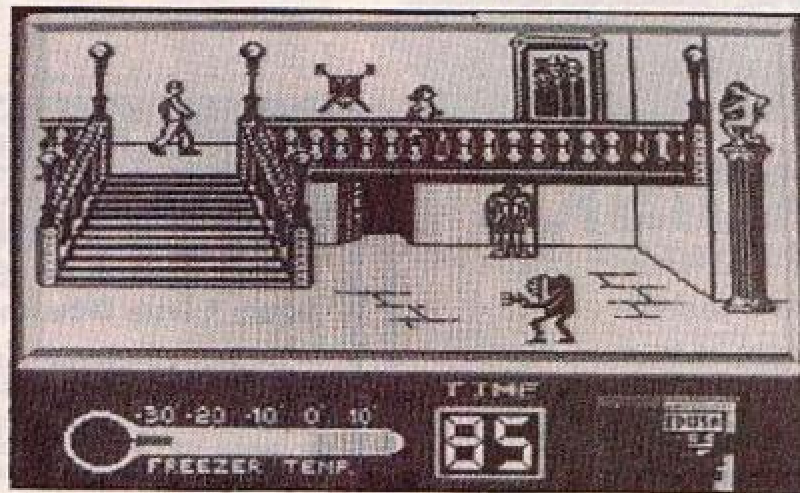
Sinclair admits that "'84 was a tough year for the QL" but insists that "'85 is going to be the year of the QL" rather than of the rival 68000-based Atari ST range which Sir Clive claims will be late and disappointing.

Harding's schedule for this year is to introduce the Infinity package on the 800 XL for around £100 this spring — this includes word processor, spelling checker, database and spreadsheet, launch the 16-bit STs in the summer and the 8-bit £170 128K XE replacement for the XL in the autumn.

The 128K 130ST will cost no more than a QL and the 520 ST with half megabyte Ram, TV monitor, 3.5in. drive, mouse, printer and Infinity less than £1,000. Whose machines will answer the 68000-based question — Jack Tramiel's or Sir Clive's — or will they settle it over 15 rounds in the Baron of Beef.


Tramiel's new Atari ST, and behind, XE micros.

ROCKY HORROR — A SMALL SCREAM



Rocky Horror: Can Brad and Janet survive?

BANNED in South Africa on the grounds that repeated showings would corrupt the nation's youth, and even more mysteriously deleted from Cliff Richard's memory the Rocky Horror Show is about to be unleased onto the small screens of a million Spectrums.

Richard O'Brien's camp, gothic, glam-rock, fantasy horror spoof musical which spun off the stage into films, records, books and parties in the mid 1970's will be a CRL computer game by March.

But writer Richard will not be playing much part in the project since he is "terrified of technology" — he does not use a word processor, nor even a typewriter. "I'd rather work with a pad and a pencil." He's leaving the programming to long-time Horror fan Ian Ellery.

You can be Brad or Janet, clean cut American teenagers as you roam the haunted and decidedly decadent house trying to free your companion who has been turned to stone, encountering such wacky characters as Eddy — the force from the freezer. While the Spectrum does not give full range to songs like *Science Fiction-Double Feature* CRL is already working on a Commodore 64 version with the declared aim of bettering Activision's rendering of Ghostbusters — but then CRL also claims that Rocky Horror is "good wholesome family fun."

Cliff Richard? — O'Brien was watching TV the other day when he heard Cliff talking about Boy George, "No-one would have thought ten years ago that a man dressed up as a girl would be a hit". "Wrong, Cliff" was O'Brien's reaction — in 1975 Rocky Horror's show stopper Tim Curry in his high heels and fishnet stockings was the talk of the town.

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	EPSON FX80 (P)	£324.00 + VAT =	£372.60
	EPSON RX100 F T (P)	£339.96 + VAT =	£390.95
	EPSON FX100 F T (P)	£430.00 + VAT =	£494.50
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(P)=Parallel-Centronics (S)=Serial RS232

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	DPS1101 Daisywheel Printer (by Juki)	£309.95 + VAT =	£356.44
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	802 Friction Tractor Printer	£260.83 + VAT =	£299.95
	1701 Colour Monitor	£173.00 + VAT =	£199.00
	Amstrad		
	CPC464 Green Monitor inc. FREE software	£209.00 + VAT =	£240.35
	CPC464 Colour Monitor inc. FREE software	£301.00 + VAT =	£346.15
	SANYO MBC 555 Business Computer		
	128K including Wordstar, Calcstar, Infostar	£795.00 + VAT =	£914.25
	Acorn/BBC		
→	Acorn Electron	£109.90 + VAT =	£126.39
→	BBC Model B	£289.00 + VAT =	£332.35
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	Sinclair		
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POP★ TOPS

SOFTWARE TOP 20

	Game	Company	Machine
↑	1 Ghostbusters	Activision	Sp
↑	2 Daley Thompson's Decathlon	Ocean	Sp
*	3 Match Day	Ocean	Sp
↑	4 Booty	Firebird	Sp
*	5 Gift from the Gods	Ocean	Sp
*	6 Select 1	Computer Records	Sp
*	7 Airwulf	Elite	Sp
↓	8 Knight Lore	Ultimate	Sp
↑	9 Combat Lynx	Martech	Sp
↓	10 Underwurlde	Ultimate	Sp
↓	11 Elite	Acorn	Bc
*	12 Starter Pack	Tynesoft	16
*	13 Savage Pond	Argus	El
↓	14 Fall Guy	Elite	Sp
↓	15 Wild Bunch	Firebird	Sp
*	16 Hunchback II	Ocean	Sp
*	17 Overdrive	Superior	El
↓	18 Skooldaze	Microsphere	Sp
↓	19 Steve Davis Snooker	CDS	Sp
↓	20 Danger Mouse in Double Trouble	Creative Sparks	Sp

Sp = Spectrum/Bc = BBC/16 = C16
El = Electron/Vc = Vic-20
Dr = Dragon/64 = CBM 64
Am = Amstrad/Or = Oric/At = Atari
* = New release/— = Same position
Source: WH SMITH

SOFTWARE TOP 3 BY MACHINE

	Game	Company	Machine
—	1 Snooker	Visions	Vc
—	2 Max	Anirog	Vc
↓	3 Duck Shoot	Mr Tronic	Vc
—	1 Kong Strikes Back	Ocean	64
	2 Hunchback II	Ocean	64
	3 Ghostbusters	Activision	64
—	1 Match Day	Ocean	Sp
↑	2 Gift from the Gods	Ocean	Sp
↓	3 Hunchback II	Ocean	Sp
↑	1 Chuckie Egg	A&F	Dr
↑	2 Hunchback	Ocean	Dr
—	3 Cuthbert in Space	Microdeal	Dr
	1 747 Simulator	Doctorsoft	Bc
—	2 Mr EE	Micropower	Bc
—	3 Forest Lord	Century	Bc
↑	1 Encounter	Hi-Tech	At
—	2 Zaxxon	Centresoft	At
↓	3 Solo Flight	Centresoft	At
↑	1 Crazy Golf	Commodore	16
↑	2 Stellar Wars Blitz	Commodore	16
↑	3 Flight 015	Craig Comm	16
↑	1 Dare Devil Dennis	Melbourne House	El
—	2 Chuckie Egg	A&F	El
↓	3 Snooker	Visions	El
↑	1 Football Manager	Addictive	Am
—	2 Star Commando	Terminal	Am
—	3 Ghouls	Micropower	Am

Source = Websters Software

YOUR Letters

MTX IS OK!

WHEN WILL games writers and micro buyers realise the potential of the Memotech series? Consider the Memotech MTX 500, bottom of the range. At a price of £199 it is MSX quality, though is not compatible with the MSX micros.

If you consider it is only £20 more than the Spectrum +, at £179, which would you buy? The MTX 500 has as much as the Spectrum + and more, i.e.:

- Higher colour resolution
- Built in assembler/disassembler.
- Sprite graphics.
- A far superior keyboard.
- 16 colours compared to the Spectrum +'s eight.
- Built in text formatting— Noddy.
- Faster operating speed.
- Louder and better sound, played through the TV's loudspeaker.
- Logo type graphic commands.
- Two joystick ports.
- Centronics/RGB/HIFI etc. ports.
- Separate Ram reserved for graphics.

So come on all you games writers and micro buyers — Think.

M E Hodges,
Shipham,
Somerset.

DATACALC BUGS

THANK YOU for publishing my article Datacalc. There are two or three errors pointed out to me since the publication, and perhaps you would be kind enough to publish the following amendments.

- If DFS is fitted then line 100 should read: 100 V1 = 45: etc.
- To use trigometrical functions in the formulae the line 1725 should be added,
  1725 IF MID $ (B$, x, 3) = "SIN" OR MID $ (B$, x, 3) = "COS" THEN C$ = C$ + MID$ (B$, x, 3) : x = x + 3 : GOTO 1720.
- In line 1770 I have used the function VAL to evaluate the value of f, I should of course have used EVAL, therefore Line 1770
  C$ = C$ – EVAL MID$ (F$(" + x $ + "," + STR$ EVAL "(F)" + ", 8)".
- I have omitted to return the printing width to its default value after a printing operation, therefore line 4875 should be:
  4875 VDU3 : WIDTH0.

Brian Law,
Leicester.

SCREEN STORE

I HAVE SEEN many programs for the Spectrum which store the screen in memory and then reprint it on request very quickly. The following program will do the same thing on the Amstrad CPC 464 computer. I advise that you only use the routine to store one screen as these screens, being more complex than their Spectrum counterparts, require more memory. Do not be fooled by the size of the routine as it uses one of the powerful features of the Z-80, that being its ability to move blocks of memory about. The routine will save any screen in any mode including colours if they are used.

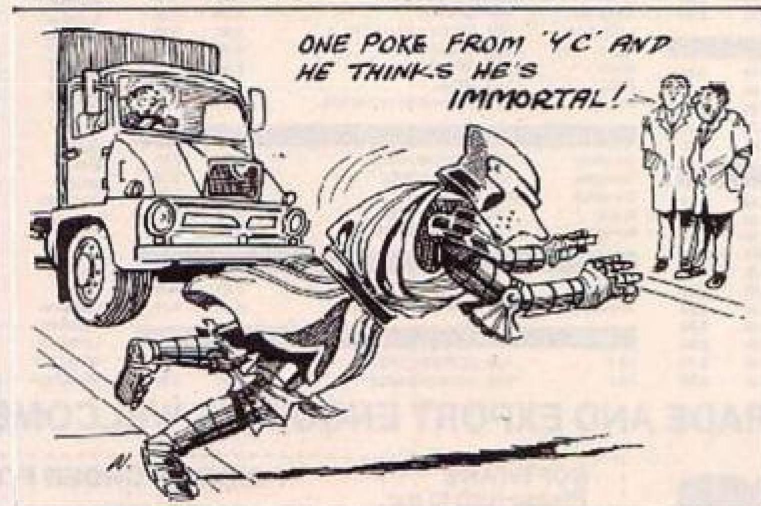
To use the routine simply Call (ad+9) to store a screen and then Call (ad) to reprint it. The routine is especially useful when changing mode after drawing a complex screen, knowing that returning to that same screen will require tedious redrawing of it. Care should be taken not to get the Call number mixed up as calling the store routine instead of the draw routine will result in the precious screen being replaced with whatever is on the screen at the time of the Call.

Type in the program as below but when you have tested it you may save it in the method described on page 42 of the manual. Once the routine has been saved in the form of bytes it can be loaded and added to your program on its own.

```
10 LET ad = 24550.
20 FOR n = 0 TO 24:READ a:POKE
   n + ad,a:NEXT
30 REM Print = ad * Store
   = ad + 10
40 DATA &f3,33,00,96,17,00,192,
   &18 8,&f3,33,00,192,17,00,96,
   0,0,¨,00 64,&ed,&bc,&fb,201
```

David Channon,
Welton Park,
C'Field.

KNIGHT LORE—UNLIMITED LIVES



I'M WRITING to you because after spending two hours totally isolated hacking my way through over 10K of machine code I can finally reveal a way of making Ultimate's masterpiece Knight Lore easier.

Just load the code from tape, enter Poke 53567,0 and run it using USR. Now play the game and — surprise! — you won't lose any lives.

I can also reveal how to finish Jet Set Willy easily. Load the code using Clear 32767:Load""Code and enter Poke 41983,255: Print USR 33792. There will be just one object in the house — in the bathroom — so pick it up and go to bed.

Pedro Fernandes,
Portugal.

ERROR NEWS

THERE HAS been an error in the article with my program Newsmonger. An important Poke command has been omitted and there was a misprint. After the sentence Poke 16511,66 N/L there should be printed:

POKE 16512,2 N/L

and you have created line 0 with a Rem containing 576 bytes.

Fram Zym,
Holland.

"BBC IS BEST"

I READ WITH some amusement Steven Hill's answer to a reader's letter concerning the QL and BBC. Having used both machines where I work I feel I can set the record straight.

For a start the claim that the QL's graphics are four times faster than the BBC's is nonsense. Perhaps Mr Hill made an error and read his time in days instead of seconds, because the BBC's graphics and Basic in general are much faster than the QL's. The scrolling is a case in point. Although the QL's Pan and Scroll commands are easier to use than the BBC's VDU23, the latter's scrolling is instantaneous due to its hardware nature. The QL scrolling is very sluggish and in order to achieve some semblance of smoothness the user has to resort to machine code.

How do you do that? Easy on a BBC, the excellent built-in assembler allows assembly mnemonics to be mixed with Basic. QL users will have problems.

As for the "outstanding technical achievement" line, Mr Hill has

(continued on page 27)

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IN ★ TOUCH

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting your name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

Telsoft

Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC — and soon the Commodore — which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in endless pages of hex digits.

Message service

You can get messages to us in two ways. Either use the Prestel Telex Link to 892084 BISPRES G or you can use our very own modem, day or night on 01-661 8978. The modem is V21, 300 baud, even parity, 10 bits per character. You simply transmit in upper case "YRC" — our address code, and wait for the acceptance code "— + + STF GO". Then off you go. Don't forget to tell us who it's for. Sign off with "NNNN" — again in upper case.

YOUR *Letters*

(continued from page 25)

obviously never looked underneath a BBC Micro. With its multitude of interfaces and ports the BBC allows the connection of virtually any peripheral.

The BBC beats the QL in other areas too — better sound, higher resolution, better keyboard, more reliable, more inbuilt features such as interrupt software and Rom routines and much better after-sales service.

Graham Walkden,
Banchory,
Kincardine.

DIGGER DIG

IN MONSTER DIGGER — *Your Computer*, December 1984 — the author, Michael Pike, warns against typing in the line number of the line immediately after the Rem as this will cause line 0 to be listed over and over again. He ascribes this to a "bug in the Rom". It is nothing of the sort and is, in fact, the normal response of the ZX-81 when you Poke an incorrect line length into a program line.

The nine Rem statements as described for lines 1 to 9 — 10 fill lines of zeroes — would each consist of Rem followed by 314 — not 320 — zeroes, and each line would contain a *total* of 320 bytes made up of line number, line length, Rem, 314 zeroes and Newline. Combining these nine lines into a single Rem statement will produce a line containing 2876 bytes — not 2816 as stated in the article — and this will be achieved by Poke 16511,60; Poke 16512,11.

If an invalid line length is Poked into 16511/12, then repetitive listing of the sort described will occur on attempting to delete the following line. It is probably worth checking, when combining lines in this way, that:

PRINT PEEK (16512 + PEEK 16511 + 256 * PEEK 16512)

does give the correct answer 118 for the Newline character at the end of the line.

N F Cunningham,
Ripley,
Surrey.

ASCII FILES

I RECENTLY HAD contact with Sinclair Research regarding a particular phenomenon with the QL and Microdrives. I had created and saved a program onto Microdrive and, on reading the number of sectors used — namely 42, assumed that the program was 21K in length. However, when the program was loaded back, the Basic pointer had moved half as much again, some 31K. The explanation was given as follows:

"A program is saved on Microdrive as an ASCII file, therefore when it is loaded it is tokenised and routine addressed appended. For example, the word Print (five bytes) is tokenised into two bytes, plus a four byte address means an extra byte is used. In fact, it appears that the user has 86K bytes available for program size as long as no new channels are used and certain print options not used."

You can build a program as a data file, and if no line numbers are used and the file is LRun, the program runs, but cannot be listed — nothing to list. To do this create the following program:

```
1 INPUT 'NAME', file$
2 OPEN-NEW #5;'mdvl-' &file$
4 REPeat build
5 INPUT L$:IF L$= ='STOP':EXIT build
6 PRINT #5,L$
7 END REPeat build
8 Close #5
```

Note line 5, two points, the first is the double =, this make the entry case independent, and secondly, a colon can be used instead of Then. If you run the program and for example input the following:

```
Paper 0: INK 6: cls
Fill 1: circle 100,50,50:fill 0
Stop
```

and you called the file "test": if you Lrun mdvl-test a filled circle will appear. This idea can be extended:

```
1 INPUT 'NAME', file$
2 OPEN-NEW #5;'mdvl-' &file$
3 lno=10
4 REPeat build
5 INPUT(lno);' ';L$:if L$= ='STOP':
  EXIT build
6 PRINT #5;lno" ";L$:
  lno=lno+10
7 END REPeat build
8 Close #5
9 MRUN'mdvl-' &file$
```

Your program is tacked onto the end of this one.

B G Cornhill,
Aylesbury.

CORRECTIONS

Lines 2266 to 2294 and line 2185 we left out of the listing for Mars Buggy in the February issue. They are given below. Enter the letters in upper case.

```
2266 dataff,ff,ff,ff,ff,ff,ff,ff
2267 data7c,fe,c6,fe,c6,c6,c6,00
2268 datafc,e6,c6,fc,c6,e6,fc,00
2269 data7c,e6,c0,c0,c0,e6,7c,00
2270 data78,ec,c6,c6,c6,ec,78,00
2271 data7e,e0,c0,f8,c0,e0,7e,00
2272 data7e,e0,c0,f8,c0,c0,c0,00
2273 data7c,e6,c0,ce,c6,e6,7c,00
2274 datac6,c6,c6,fe,c6,c6,c6,00
2275 datafc,30,30,30,30,30,fc,00
2276 data7e,3c,0c,0c,0c,6c,38,00
2277 datac6,ec,f8,f0,f8,ec,c6,00
2278 datac0,c0,c0,e0,e0,e0,7e,00
2279 data44,ee,fe,d6,c6,c6,c6,00
2280 data46,f6,fe,fe,ee,e6,46,00
2281 data7c,f6,e6,e6,e6,e6,7c,00
2282 data7c,f6,e6,fc,e0,e0,60,00
2283 data7c,c6,c6,c6,66,3c,0e,00
2284 data7c,c6,c6,fc,f8,cc,46,00
2285 data7c,c6,c0,fc,06,e6,7c,00
2286 datafe,98,18,18,18,18,18,00
2287 data44,c6,c6,c6,c6,c6,7c,00
2288 data00,00,00,00,00,00,00,00
2289 datac6,c6,c6,c6,e6,7c,38,00
2290 datac6,c6,d6,d6,fe,d6,82,00
2291 data66,66,3c,18,3c,66,66,00
2292 data44,ff,00,ff,00,ff,00,ff
2293 data00,ff,00,ff,81,4c,44,41
2294 data00,00,00,00,00,00,00,00

2185 data3e,03,ac,56,03,b9,00,40
```

In the same issue the hex loader for Spectrum Synsounds and Spraymania contains a few errors. To correct it insert lines 75 and 115, and change line 100:

```
75 LET x=0
100 POKE n+x,z
115 LET x=x-1
```

"THE DRAGON ISN'T PUFFED OUT".



ONE WONDERS where the software houses think we Dragon owners have gone to. When the manufacturer goes bust and is sold off to some Spanish company, the hapless computer owner doesn't throw his machine in the bin and replace it with the latest offering. No, he carries on as normal.

There is no alternative. In the case of the Dragon, the computer represents a capital cost of somewhere between £150 and £230, depending on the time of purchase and the model.

Second, there is no obviously better computer. I own a Dragon 64 running on OS-9. This Unix-based, multitasking operating system has no equal in the home computer world. Using the stylograph word processor I can do in 20 seconds that it took Kathleen Peel over three minutes to do using Quill on a QL.

David Ferguson,
Wendover,
Buckinghamshire.

I could do that...

January's problem asked you to write a 10 line program which created an interesting or artistic pattern. We awarded the £15 prize to P. Duyvesteyn, Wijnruitgaarde 30, 3436 HR Nieuwegein, The Netherlands. His program is written in Simons Basic for the Commodore 64.

It allows you to create a variety of different patterns by altering a few parameters. Adapting it to run other machines should not prove too difficult. You will need to change line 170 which takes two pairs of coordinates and draws a line between them. The Commodore 64 has a resolution of 320 by 200 so the figures 160 and 100 position the pattern in the centre of the screen.

For this month's competition we would like you to write a program which modifies itself. To do this you will need to find out how your version of Basic stores its program lines, and you will undoubtedly have to use Peeks and Pokes.

Programming purists will tell you that self-modifying code is a "dirty" programming technique. But it can produce some entertaining effects such as a program that extends itself by a given number of lines every time it is run. Your program should not have more than 20 single statement lines.

```
100 INPUT"LENGTH           ";L:
    INPUT"GROWTH OF LENGTH";GL
110 INPUT"ANGLE            ";A:
    INPUT"GROWTH OF ANGLE  ";GA
120 INPUT"NUMBER OF SIDES  ";S:
    INPUT"ROTATION ANGLE   ";RA
130 P=π/180:A=A*P:GA=GA*P:RA=RA*P:[illegible]
    [illegible]
140 :
    :HIRES1,0
150 :::::FORJ=0TOP STEP RA     :FORI=1TOS
160 :X1=X0+L*COS([illegible])
    :Y1=Y0+L*SIN([illegible])
170 :LINEX0+160.5,Y0+100.5,X1+160.5,
     Y1+100.5,1
180 :X0=X1:Y0=Y1:L=L+GL:[illegible]
190 :::::NEXT:[illegible]
    :::::N=0                   :NEXT
200 GOTO200
```

L= 95 :GL=-1.5 ;A= 62.5
GA= 0 :S= 65 ;RA= 60

BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

YES, NINE OUT OF TEN CP/M PACKAGES CAN'T TELL THE DIFFERENCE.

WILDING.

What does CP/M do?

OPERATING SYSTEMS were discussed in January's First Bytes, where it was explained how they carried out all the boring housekeeping functions on a micro. One of the most widely-used operating systems is CP/M. And for eight-bit home and business micros it definitely rules the roost.

CP/M stands for Control Program for Microcomputers — which sums up neatly just what it and other operating systems do. The story of its development is one of those fairy tales that seem so common in the magic world of micros.

CP/M was written because its inventor, Gary Kildall, wanted to hook up some early floppy disc drives to an equally early eight-bit microprocessor system. In those far-off early days of micros — that is about 10 years ago — if you wanted something like this you had to write it yourself. Which is what young Gary did, in his garden shed in fact. The resulting product was not very elegant, but it worked.

It occurred to Kildall that other micro enthusiasts might be interested, so he told the big semiconductor firm Intel, who he was working for at the time, about his little idea. They scoffed at the preposterous suggestion of bothering to write an operating system for a mere micro. After all, IBM itself had let it be known that it thought micros were merely a passing fad.

But like all good fairy stories, the CP/M story has a happy ending — though not for Intel. Kildall first put a few ads in computer magazines, and sold increasing numbers of his system.

In fact he started selling so many that he set up his own firm, Digital Research, just to market and sell CP/M. Today he is a multi-millionaire, and his firm produces a whole range of software products.

So why did everyone — apart from Intel — get so excited about CP/M? Mostly because it happened to be in the right place at the right time. It certainly wasn't a stunningly beautiful piece of programming: even today, the product is not very user-friendly, and can be bafflingly obscure. And it certainly wasn't simply because of hype and brilliant marketing: to begin with, Kildall almost had to be coaxed into selling it at all.

But CP/M offered first the possibility of using disc-drives with one of the new processors. As January's article explained, looking after the discs and input and output of information is one of the prime jobs of an operating system, sometimes also known as a disc operating system.

But the second big advantage was that CP/M offered for the first time a general standard that everyone could use to swap discs and therefore programs. Before CP/M, everybody and every manufacturer concocted their own weird and wonderful disc operating systems.

Unfortunately, this meant that the user was very much locked in to that particular system. Today only giants like Apple can still use their own non-standard operating system and get away with it. Practically everyone else uses one like CP/M.

In this way a huge library of software running under CP/M has been built up; it currently stands at something over 3000 packages. Running "under" CP/M simply means that while the software contains all the interesting parts that make it a shoot-'em-up or a word-processor, it leaves the actual details of getting data in and out of the micro to the operating system.

Theoretically, then once you have got a CP/M system you can run any (continued on page 31)

(continued from page 29)

of this software straightaway. As ever, though, life is not quite that simple. CP/M was first developed on the now almost extinct 8 in. discs. Later the standard 5.25 in. floppies were used. Now of course, we have 3.5 in. and 3 in. discs. Obviously you cannot run programs from the wrong-sized discs. But you also have to check that the format of the discs are the same. This can vary from machine to machine, even if they all run CP/M.

You normally boot, that is load up, CP/M from a disc. As the drive whirrs, the operating system program is being loaded into the main working memory of the micro, the Ram — random access memory. Booting — short for bootstrapping — requires some very simple program already in the micro to carry out this first operation. It is only after CP/M itself has been loaded that it can be used for more complex operations. This processing is called bootstrapping by analogy with someone pulling him or herself up by their own bootstraps.

CP/M signals that it is ready to accept your commands by means of the simple prompt a>.

The a refers to the disc drive you are currently using. If you have a second drive it would be called b, and so on.

There is a certain class of commands that are always available, and can be run immediately. A second class, called rather grandly "transients", have to be pulled in off the CP/M master disc to Ram before they can be run.

One of the most useful of the first class is DIR. Entering this command produces a directory of all the files on the current disc. You can copy files from disc to disc using copy, which is a transient command, and has to be loaded each time you wish to use it. This cannot, however, be used to copy the CP/M program itself. This has to be located right at the outside of a disc, and requires a special command SYSGEN, short for System Generator, another transient.

BEGINNERS first bytes

CP/M is mainly used with micros based on the Z-80 processor. Popular machines which are built around this chip include the Sinclair Spectrum and the MSX machines. As yet, however, these do not run under CP/M.

The Amstrad, which also uses a Z-80, does plan to offer CP/M when its disc drive appears. For other machines you normally have to buy an add-on which contains a Z-80 as a second processor running in parallel with the main chip. This is the technique used with the BBC micro and its Z-80 second processor unit.

As well as offering CP/M for more advanced 16-bit machines, Digital Research has also produced something called Concurrent CP/M. As its name suggests, this allows you to run several programs under CP/M concurrently, that is at the same time. Obviously, you need much more internal memory for this to hold all the programs simultaneously.

Even if it is unlikely therefore to filter down to the cheapest home micros, it is still an exciting development, and shows that there is life in CP/M yet.

Recording, storing and retrieving program data

THE VERY EARLIEST computers had programs laboriously entered by hand, machine code bit by machine code bit. The program was stored simply by existing physically as a series of small pegs inserted in holes on a board.

Later, technology progressed to allow streams of bits to be held in what was called a delay line — which did exactly that. A long tube was filled with fluid, and crystal oscillators and receivers used to send pulses along its length. An amplifier could keep a set of digits flowing around the tube for later use. Unfortunately, when you switched that power off, the information was lost. In this respect, these early storage devices were rather like the modern day Ram that dies when the micro is turned off.

True storage of programs began with the punched cards and streams of paper tape. Series of holes in them were read, first mechanically, and later optically, to produce corresponding electrical digits — a binary 1 for a hole, and a binary 0 for no hole. Ultimately magnetic media were developed, that allowed much higher storage densities and far swifter retrieval times.

The commonest form of data storage found in home micros is the audio cassette tape. Programs are simply converted into a series of audio signals that can be recorded onto the magnetic tape like any other noise. A beep is used to represent a binary 1 and the absence of a beep a binary 0.

When a program is loaded from a tape a similar process of translation is used to convert these audio signals back a series of electrical impulses which the micro can deal with.

There are obvious problems with this technique. First, the audio cassette is hardly a high-precision piece of equipment. Tiny faults that would be unnoticeable in audio playbacks could cause changes in single bits that would be fatal in a program.

The medium is also slow. Ordinary cassette recorders just cannot handle very fast changes between beep and non-beep.

Finally, and in some ways most inconveniently, to find a particular item on a tape you may have to run through nearly all of it. Similarly, you cannot go back to a particular spot without rewinding the whole tape. The Microdrives from Sinclair try to get round this by using a continuous loop of tape, rather like the old tape cartridge.

This type of medium is called sequential, because you must go through the information stored in it in sequence. You cannot jump from one part to another. The latter type are called random access, and are both faster and generally more expensive than sequential systems.

The most familiar type of random access storage is Ram, which gets its name from random access memory. But like the delay lines, it is volatile — that is, its contents are lost as soon as you switch off the machine. However, the floppy disc is also random access, and retains its data.

Floppy discs use the same basic kind of recording technology found in audio cassettes, but instead of having a long thin strip they spread the magnetic coating over the surface of a plastic disc. The disc rotates at high speed — typically 300 rpm — underneath the reading and writing head of the unit. This is very similar to the head of a cassette deck.

But the high speed of rotation, and the precision tooling which allow the head to touch lightly the disc's surface mean that about 10 times as much information can be stored on a typical disc. It is also possible to up and download programs from it very much faster.



The discs are divided up into concentric tracks, and the tracks into sectors. These tracks are not physically visible on a record, but are determined by the process of formatting.

Before using discs, you normally have to use a formatting program which places small magnetic markers on its surface setting out the possible positions for data to be stored. Most discs nowadays are soft-sectored in this way, though a few are hard-sectored: they have small physically marks that divide up the surface into regions.

Many different manufacturers lay down the marks on their discs in different ways. This means that although the micro could theoretically run a program written in say Basic, it might not be able to read from the disc because the formats are different. Another factor to be considered in this area of compatibility is whether a disc is single or double sided, and what the density is.

These are the new 3.5in. floppies. Older versions were 5.25in. and before that even 8in. Even though the physical size has come down this dramatically, capacities for floppies are well up into the Megabyte region.

There is a more expensive version of floppies that is just beginning to filter down to the home computer market. This is the hard disc. Whereas floppies allow you to remove and replace the disc system, which means that the whole design must be that much more robust, hard disc systems are completely enclosed in airtight containers. Far higher rotation speeds can be employed, allowing faster access and much higher densities. Hard discs — or Winchesters as they are sometimes known — can store 100 Megabytes and over.

Looking into the future, there is a technology just beginning to come through which promises even more fantastic storage capacities than those of hard discs. This is the optical disc.

Tiny pits are burnt into a plastic disc by a laser beam. This same beam can be used to read them: a pit represents a binary 1, and the absence of a pit a 0. Systems have been designed that can store about 1 Gigabyte of data — that is 1000 Megabytes — on a 12in. disc.

If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Grüningen

The newly-founded Swiss Sinclair User Club seeks members. They are keen to establish links with similar clubs in Germany and Austria. Main language of the club, apart from Basic, looks like German, but since it's Switzerland, all you French, Italian and Romansch speakers should write to Sinclair User Club Schweiz, Postfach 16, CH-8627 Grüningen. Tel: 01 241 19 08 or 01 948 00 25.

Blackburn

Blackburn Computer Club meets on alternate Mondays at the Fernhurst Hotel, Bolton Road, Blackburn, at 7.30 in the evening. All machines welcome. Membership is about £5 for adults and £3 for juniors. For more details contact John Schofield on 0254 28127.

Lincoln

Lincoln Computer Club is part of Lincolnshire Microprocessor Society and has some interesting evenings billed for the future including "Music and Computers" and a visit to the Computer Control Unit at the NatWest Bank. The club meets at the Cardinal's Hat, 268 High Street, Lincoln. More details from Douglas Griffiths, 659 Newark Road, Swallowbeck, Lincoln LN6 8SA. Telephone: 0522 680578.

Colwyn

Colwyn Computer Club meets at the Greens Hotel, Colwyn Bay. Contact D Bevan, c/o Abergele Road, Colwyn Bay, Clwyd LL29 7PA.

COMPUTER club

Paul Bond discovers one of the great grandaddies of computer clubs with modern ideas in Harrow.

THE HARROW COMPUTER Group must surely be one of the great grandaddies of the fraternal programming phenomenon. It can claim to have started meeting informally in late 1968 — yes, 1968 — and was formally constituted in early 1969. Some of our younger readers may imagine that the biggest problem the original members had to contend with was dodging pterodactyls on the way back home — but the pioneering home computer of this time was the Nascom I.

"Machines seem to go in phases here," opined one club member. "First there was the Nascom, then the Commodore PET, then the BBC. I don't know what'll be next". Many major computer industry figures almost certainly share this uncertainty.

Wednesday night — or at least the alternate Wednesday night — is robot night at Harrow, at least in theory. Bazyle Butcher, self-styled ex-chairman of the club, had brought along a prototype turtle-oid device that he was working on, and on previous evenings various types of robots had been known to make an appearance.

Mr Butcher was at pains to point out that while he himself is a microwave engineer, membership of the club is drawn from all walks of life. This was certainly evident on the night *Your Computer* attended the club. One member, a British Telecom manager, had acquired a BBC to learn Basic. Other members included a gentleman who worked for a builder's firm and maintained that he used it for running the company golf club, a member of the Metropolitan police force, and a lady who displayed such a remarkable reluctance to reveal her name or occupation to the press that she must be assumed to work for some secret department of government. One would have thought we were going to make fun of her.

Some of the younger members of the club were engaged in a game entitled "BMX on the Moon", but criticism of games software for the BBC machine was not restrained — certain companies, like Aardvark Software, however, were considered to have produced some quality material.

Recent club lectures have included a talk on telesoftware by Bob Tidy, and a discussion of Commodore programming techniques led by Peter Calver of Supersoft. Doubtless this will attract members of the PET group, who currently meet in a member's house. The Harrow Computer Group has plans for a stand as usual at the London Festival of Computing to be held April 9-21. Inquiries about the Festival should be directed to BIPR on 01-734 2907.

Apart from lectures, hardware evenings, and attendance at exhibitions, the club operates a members' library. This contains British and American magazines, technical books and also a Buzzbox modem.

The Harrow Computer Group is a member of the Association of London Computer Clubs — Bazyle Butcher is an ex-treasurer of the ALCC — as well as being affiliated to the Association of Computer Clubs national group.

Membership of the club also entitles you to visit Croydon Micro Club, the Independent Commodore Products User Group clubs, Sutton Library Club, North Kent Amateur Computer Club — and this is to name but a few.

HCG meets at 7.30 pm on Wednesdays in the Kenton Room at the Harrow Arts Centre, opposite the Alma Public House in Harrow Weald. Membership is £5 per year or you can visit for 50p a meeting. BBC users should contact E Londy on 01-907 7430, PET users should contact P Butson on 01-907 5355.

For information about main group meetings telephone N Merton on 01-204 9127 or A Diston on 01-904 2559. Club Secretary is Norman Campbell, reachable on 01-863 5241.



ADD-ON EXTRA

Softex

Printer Interface
CBM 64/Vic-20
£20.95

Now that the price of the Alphacom 32 thermal printer has dropped to £54.95 Softex's Printerface looks very good value indeed. It allows Vic and CBM 64 owners to take listings on the Alphacom 32 across 32, 42, or 63 columns. This represents a saving of at least £130 over the cost of a Commodore dot matrix printer.

The Printerface consists of a cable which plugs into the user port, and the software on tape needed to drive it. As well as offering a double height option it handles Commodore graphics characters and screen dumps. Since the Alphacom uses four inch wide paper it is probably not suitable for word-processing purposes but in every other respect compares well with Commodore printers. For an example of its print quality see the listing for the Vic Basic Extensions article in this issue.

Printerface can also be connected to the Sinclair ZX Printer. It is available by mail order only from Softex Computers, Bournemouth Tel: 0202 422028.

Oric Products

Bus Cover
Oric/Atmos
Free

A small piece of plastic is available from Oric products to stop owners from blowing up their Orics whilst groping around the back of the machine to find the socket for the power jack. It covers the expansion bus and can be removed when you want to plug something in.

Ram

Joystick interface
Spectrum
£11.50

The joystick interface is Kempston compatible, and will take any sort of "atari" type joystick, including quickshot II and rapid fire. Unfortunately there is no continuation of the expansion bus. Available from retailers.

HARDWARE hotlist

Penman

- *BBC*
- *Penman Products Ltd.*
- *£217*

Is IT A plotter? Is it a robot? Is it a mouse? No, its Penman. Set this handy little gadget down on a piece of paper and away it goes plotting smooth lines in three colours. You can also draw curves using polar co-ordinates.

With a suitably white piece of paper on a black background, the Penman will initialise itself and find the corner of the paper using its light sensors. The three pens drop in to their holders and the mobile robot is connected to its base by a ribbon cable. Despite its size it is capable of good resolution — 0.03mm — and tight circles. Its performance certainly compares well with conventional flat-bed plotters.

Not content with this, the Penman can be used like a "mouse", or a "rat" to be exact as it has no actuate button. Two light sensors are built-in to enable the unit to find the edge of the paper and these can be used to digitise pictures although the resolution is rather low.

The software is only available on disc and has a number of demonstration routines and utilities. The utilities show you how to incorporate commands to the Penman into a Basic program, as well as using direct single letter instructions. The software can also be used with the Acornsoft Logo language.

Standard plotter pens are used which are widely available in a variety of widths and colours. You can even use a humble Pentel!

In theory, Penman could be used with any computer with a serial interface and some information is given in the manual on programming. However, it seems likely that the machine's big market will be in schools where it can demonstrate the simple principles of robotics, and might come in handy for plotting results or charts. The unit appears rugged and should stand up well to the classroom environment.



Above: Penman plotter.

Below and left: Examples of Penman's work.





Oric Modem

- *Oric/Atmos*
- *Oric Products*
- *£99.95*

WINNER OF the "coming soon" award for late arrival two years running, the Oric modem, announced at the launch of the Oric-1 has finally arrived. Oric have stuck with their policy of badging-up a tried and tested product and designing a custom interface. The modem is plugged into a new-style BT phone socket and the phone is plugged in to the modem. The phone can still be used normally.

A short piece of ribbon cable connects the expansion port to the small, slim box containing the interface which is connected to the modem by an RS432 cable. This interface will be built-in to Oric's new IQ164 computer which can be connected to a wide range of modems.

The system software is available on tape or disc and contains all the software necessary to use the computer as a Prestel terminal. Although a half-duplex 1200 baud mode is available this is not used by the software, and insufficient technical detail is given for the user to attempt to write such software himself. Oric do say that some communications software is under development. The Prestel software is pleasant to use with the keyboard conveniently redefined for Prestel commands.

The computer's memory is used as a buffer so that pages the user wants to store are filed, and then dumped to tape or disc offline.

For business users, a separate company, Cytel is also marketing the modem. For an extra £45 you get the same hardware but with the Cytel software. This is an improvement on the Oric software, although it is only available for the Atmos. It features auto I/D and password transmission and has an offline message buffer, allowing mailbox messages to be prepared before logging on.

This software is obviously only worth it if you plan to use Prestel very extensively. One gripe is that you can't view a catalogue of programs stored on disc. However, Cytel do say that users will get software upgrades when these become available.

Both sets of software allow pages to be recalled and printed on an Epson-type printer, double size. The modem was completely relible during testing and the software performed competantly, occasionally getting tied up with hamfisted treatment. But for the price, it looks bad value for money beside some new releases. However, this is the only modem with software designed for the Oric, although Protek have one in the pipeline which will have communications software as well. Micronet has no plans to support the Oric at the moment, but much depends on the demand from Oric owners.

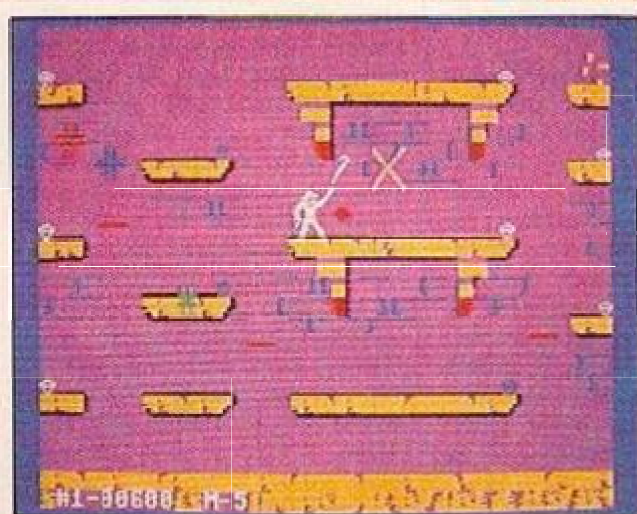
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The artifact is just too tempting. Sure, no one has ever returned with it but they didn't have your brains and courage.
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Of course, there is the small matter of finding it. The perils en route are sure to be the most fiendishly clever traps and puzzles you've ever faced. You'll need all your skill and daring just to survive.
Then there's the ancient curse . . . but what the heck; if it were easy, it wouldn't interest you, Dr. Jones – would it?



C= 64
CASSETTE
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£9.95
★ ★ ★

3-D mazes have been around on some micros almost as long as bat'n ball games. Acornsoft's is a highly superior version which enlivens the basic concept with bullet-firing robots, lifts, and fast scene changes. Equally pleasing is the way it mixes colours to decorate the corridors in a range of soothing pastel shades.

Labyrinth

BBC B
Acornsoft
Arcade adventure
£9.95
★ ★ ★

Roam seven levels of a labyrinth in search of the extraordinary seventh crystal. On route you can shoot or crush a variety of exotic creatures, or replenish yourself by eating fruit. The idea behind the game is far from novel but the way it is executed — smooth scrolling, superb animation — lifts it out of the ordinary: another confirmation of Acornsoft's return to form.

Break Fever

CBM-64
Interceptor Software
Educational
£7
★ ★ ★

Hey you! No matter what your crew this is the plastic with a program for you. Break dancing on computer with a pre-recorded track — are you bad news or just slack? Crucial, well hard, cronic man too styley, murder — maybe that's you.

Stylo, wacked, they've got all the terms; try some wild style and burn baby burn. Written by Hardip Mothada and Dennis Reilly, this game consists of manipulating a break dancing figure using a joystick. You can do donkey kicks, space shuttles, headspins, flips, back slams and backspins.

SOFTWARE *Shortlist*

Match Day

- *Spectrum 48K*
- *Football Action*
- *Ocean*
- *£7.95*

★ ★ ★ ★

THE THRILLS of *Match of the Day* and — no Jimmy Hill. To some extent Ocean has realised that football fans' dream with Match Day? For well over a year International Soccer for the Commodore 64 has been unchallenged as the top football action game for any computer. Now the Spectrum is back in the running.

Of course the limitations of the Spectrum's screen handling makes Match Day's graphics inferior to the CBM-64 game. But Ocean's program compensates for the poorer graphics with subtler controls which allow you to develop a whole variety of ball-playing skills.

Imagine watching a match from the TV camera's gantry high up in the main stand. That's the view you have of the action which scrolls smoothly as the play moves from one end of the field to the other.

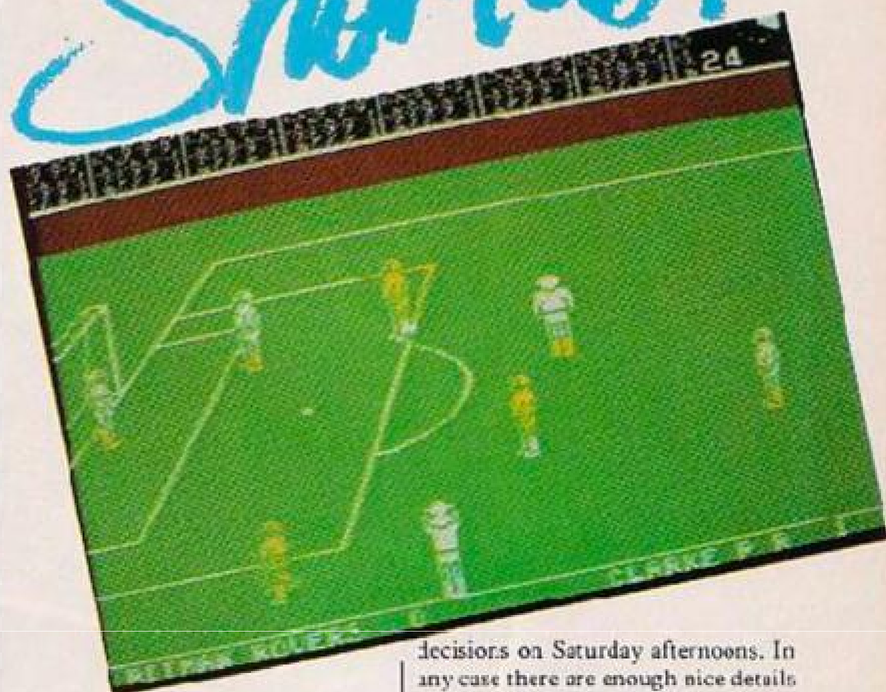
Match Day is a two-player game or if you want some really tough opposition try out your own brand of total football on the computer's International level. It's the top level of three and it never puts a foot wrong.

The program's Amateur and Professional games are also very good but beatable, and they are the only place to start if you've never played before — especially when you are trying to perfect the penetrating throughball.

Set pieces like corners, throw-ins and goal kicks can be very finely timed and crushingly effective. In situations like these, as in the normal run of play, you can vary the angle and the pace of the ball. Probably one of the most difficult techniques to master using the joystick is the diagonal crossfield pass along the ground. But once you have got the hang of it, it really can cut the computer's defences to shreds.

Control passes from one team to another according to whichever is closest to the ball. Although that may sound simple, trapping and controlling the ball itself is another matter. The only way to do that effectively is to watch the ball's shadow and move your man to where you expect it to land.

As the slightly arthritic-looking players troop out on to the pitch to a rendering of the *Match of the Day* music, you might wonder what Jimmy Hill would make of some of the refereeing decisions the computer allows. The goals scored directly from throw-ins would certainly make that famous chin drop in disbelief. And most commentators would soon run out of clichés if in real matches the ball were to stick unmovably behind the goalkeeper for a whole half at a time.



But you soon get used to that — just as you learn to live with bad decisions on Saturday afternoons. In any case there are enough nice details in this program to make up for the shortcomings. It's good to be able to name your own teams, choose the colours they'll be wearing as well as the competition they are playing in. All in all, a credit to the game.

Toby Wolpe



1985 The Day After

- *CBM-64*
- *Mastertronic*
- *Tunnel twister*
- *£1.99*

★ ★ ★ ★

THIS GAME GETS four stars because it's value for money (cheap). Compared to other Mastertronic programs, this one shows great style — so much so that I thought they would have it on a different price scale. But no, it's still good bargain basement stuff. The game itself has nothing to do with Anthony Burgess, George Orwell or American TV movies about the third world war.

You fly a lunar module lookalike off its launch pad, sideways along a tunnel, then up and out into outer space. Position the lunar bug over one of the brightly coloured moons hanging in the sky and you instantly tesseract into a different landscape.

Here your job is to collect little pink dots or nuclear plasma, as the technically-minded term this phenomenon. Passing UFOs — exactly like the ones in the classic Gerry Anderson TV series "UFO" — hinder the garnering process.

Using the lunar teleports you can jaunt off to 12 alien landscapes according to the inlay — I only managed three that looked radically different. If you are an ace spacer, you qualify to collect the fusion core from the last most difficult cavern. The main problem for the novice space trucker is getting out of the hanger. Once you've mastered attitude and thruster control, together with the use of the tractor

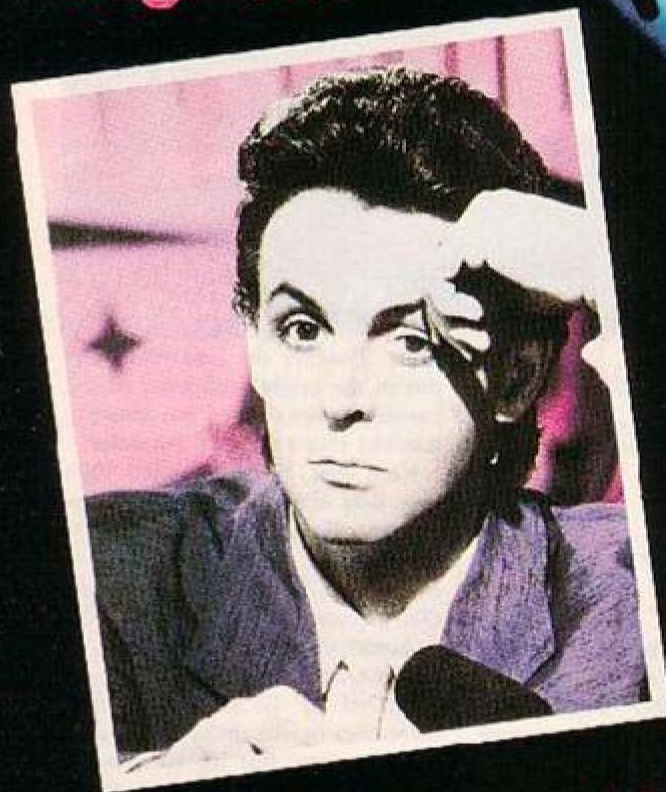
(continued on page 39)

...7 busy characters, 10 lost chords, 12 hours, 48 Traffic Wardens, 95 London Tube Stations, 126,720 square feet of London, 7 million Londoners... 943 action filled screens.

PAUL McCARTNEY'S *Give my regards to*

BROAD STREET

When the music stops, the mystery begins...



MIND GAMES

COMMODORE 64 – £7.99



© 1985





Star chart

Penetrator

CBM-64
Melbourne
Arcade
£6.95
★ ★

Hailed as the best version of Skramble for the Spectrum, Penetrator now makes a belated appearance on the CBM 64, a machine already well catered for Skramble-wise. Not one of the great CBM Skrambles perhaps but deserves a place in the top 10 for its excellent graphics, rousing soundtrack, training mode, and — a new feature — an option for redesigning the landscape.

Pyjamarama

Amstrad CPC-464
Amsoft/Mikro-Gen
Arcade adventure
£12.95
★ ★ ★ ★

Excellent graphics, a reincarnation of the game that attracted so much praise when it first appeared on the Spectrum. Find the alarm clock and wind it up to end Wally's nightmare. You have to pick up objects to achieve this goal, and an interesting feature is the way you can change the objects by passing over them. Makes some software houses look like wallies by comparison.

Finders Keeepers

Spectrum 48K
Mastertronic
Platform
£1.99
★ ★ ★

If you've never played a platform game, then this one might be worth a try. Your quest is to travel round the castle of Spriteland, collecting up treasures which the king has carelessly left scattered around his castle.

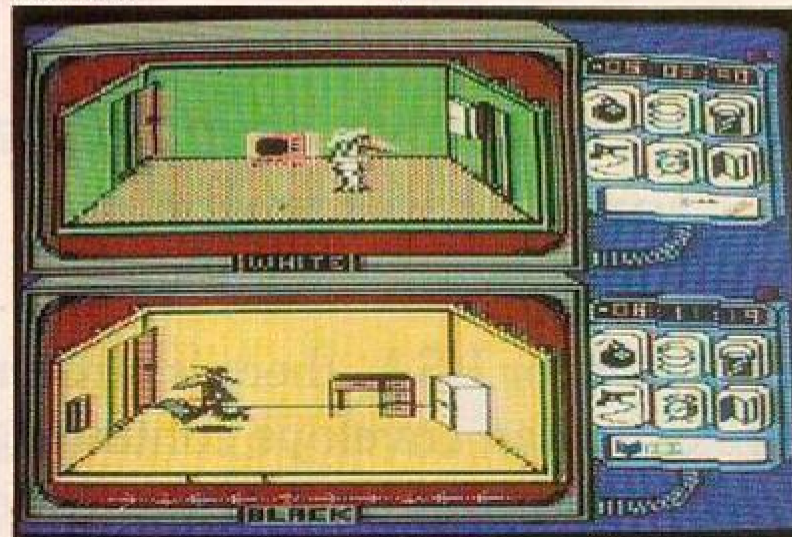
There are the usual collection of baddies trying to kill you, a maze and a large number of screens. You can only carry five objects at a time, and you can then trade them for cash, or be a good fellow and return them to the king.

(continued from page 37)

beam, the game becomes a real tooth-clencher — an orginal approach to the Lunar Lander stereotype. This game puts substance in the image that Mastertronic tried so hard to create in their first days; that of being a real threat to the established pricing structure of the home computer software market.

Paul Bond

SOFTWARE Shortlist



Spy vs Spy

- *CBM-64*
- *Beyond*
- *Arcade Adventure*
- *£9.95*

★ ★ ★

ESPIONAGE HAS COME on a long way since the cartoon strip Spy vs Spy first went undercover in a 1960 edition of *Mad* magazine. Buckets of water, metal springs and guns attached to pieces of string are hardly the tools of the cloak-and-dagger trade that Smiley or any of his people would recognise.

But together with anarchist-type bombs with fuses and exploding alarm clocks they make up the armoury you use to outwit your opposite number and to escape from the embassy with a briefcase full of secret documents.

Two players can play this maze game or you can try your luck against the black spy controlled by the computer. You can even stack the odds in favour of your spy's mission by giving the computer a low IQ. Game options also include maze difficulty as well as keeping the door leading to the get-away plane hidden until all the objects have been collected.

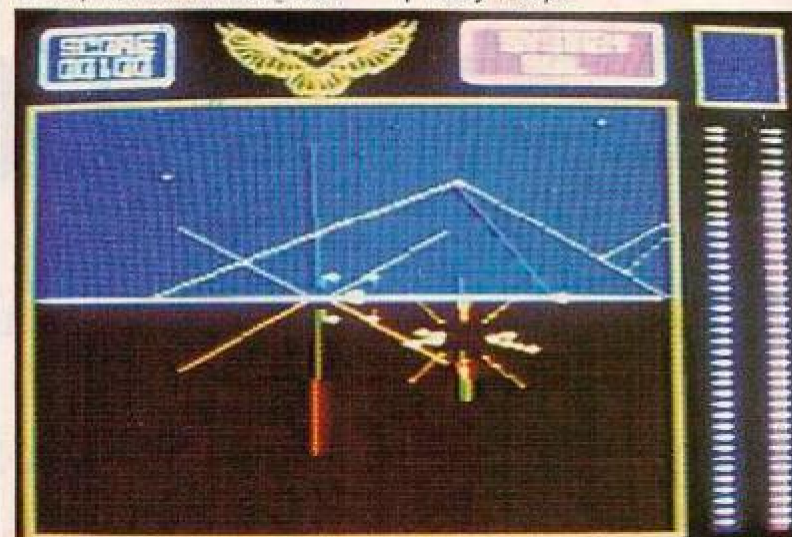
Although Spy vs Spy is no more than a maze adventure of the collect-the-objects-and-escape variety, the split-screen graphics and animation are very good. You can watch what nasty surprises your opponent is preparing for you on his screen and take evasive action by collecting the right object to protect you from it — umbrellas hidden behind coatracks are the only answer to the old bucket-behind-the-door trick.

To the right of the two screens are the Trapulators. Spies switch over to them to select the booby-trap they need or to look at the map. They also show the objects you are carrying, and the time left to complete the mission.

When you stumble across your rival secret agent searching for objects, it's hand-to-hand combat time. The only other option is to run and if you do, you risk losing items.

These combat sequences are fought out with wooden clubs, and the joystick movement you adopt determines whether you are going for a jab to the stomach or the head-smash. The loser dies and not only has the indignity of fluttering off to heaven in the form of an angel but also loses precious time.

Toby Wolpe



Stellar 7

- *CBM-64*
- *US Gold*
- *3D Matchstick Tanks*
- *£9.95*

★ ★ ★

I WAS A LITTLE surprised to find myself earthbound in an Atariesque Battle Zone scenario when the program eventually loaded — from the cover picture I deduced that I would be thrown headlong into some three-dimensional outer space shoot-'em-up, wreaking chaos in the vastness of the cosmos. But getting around between the seven star systems in the game is achieved by driving your XCV Agl-2 Raven vehicle straight into a Warplink. You only get to see one of these when you have vanquished everybody locally.

Grabbing a statistic out of the air, only three orginal games have been written for the Commodore 64 — and this is obviously not one of them. But then most machines, except for the proud and haughty BBC Micro, now have a commonalty of software that extends far beyond the ubiquitous Space Invaders. This is a stylish implementation with some nice touches. The cassette contains a Raven Manual — an essential prop to those intent on living out the delusion that they are an interplanetary tank commander. Quite mad and so young.

Once you have got your code nine security clearance you'll be able to appreciate some of the finer control features. There is a zoom lens option on the viewscreen which enables you to identify distant objects. Naturally, you have protonic shields whose current strength is indicated on the blue gauge located on the right side of your viewscreen in the leftmost position. You can also render the Raven invisible — a well known spin-off of protonic shield technology. Once you've got the hang of all this, you can go in for the advanced driving test.

Tips and hints are provided: don't refuel at a fuel-bay until it is time to warp out, fuel-bays can only be used once. There are lots of tactical manoeuvres to master like "the move" and "firing in the interim".

Why all this technology is necessary when the enemy is plainly reduced to constructing its hardware out of matchsticks has always been beyond me. Still they pack a nasty punch, and as it says in the manual, the guiding principle of all these manoeuvres is simple: hit your target without getting hit. Receiving you loud and clear. Over and out.

Paul Bond

(continued on page 41)

SOFTWARE Shortlist

Star★chart

Mr Wong's Loopy Laundry

Amstrad CPC 464
Artic
Platform game
£8.00
★★

Average game in which Mr Wong has to collect his laundry whilst being pursued by a flying iron, a sack of laundry and soap suds that are definitely not soft. The hardpressed Chinaman moves right and left and up and down the ladders dodging the hazards and collecting the washing. A platform game is a platform game is a platform game.

Brian Bloodaxe

Spectrum 48K
The Edge
Arcade adventure
£7.95
★★

Over-hyped little number from the cutting Edge of Softek. Features over 100 screens, with more than 300 foes weapons and surprises. Every screen presents a logical problem — but what computer game doesn't? Graphically pedestrian, should have been released on the Softek label at a more reasonable price. Plays Sousa march, as per Monty Python — an old BBC TV comedy series, apparently.

Sentinal

CBM-64
U.S. Gold
Arcade/Strategy
£9.95
★★★

Star Raiders is widely regarded as a classic. Until now only available for the Atari, Sentinal is a conversion to the Commodore. Your job is to destroy the alien bases whilst stopping the ships from attacking your bases and home planet — their ultimate goal.

This requires a nice balance of defence and attack, as well as speed and reflexes. Despite being a classic in its time, it does look a little dated next to some more recent releases

(continued from page 39)

Zaga Mission

- *CBM-64*
- *Anirog*
- *Chopper hopper*
- *£7.95*

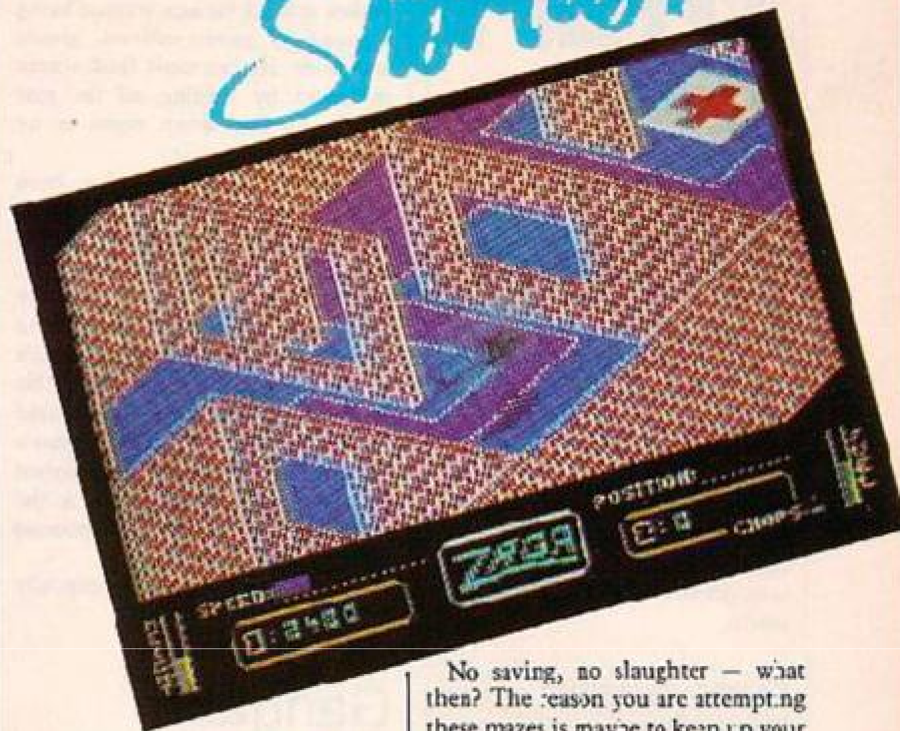
★ ★ ★

THERE ARE so many helicopter games on the market now that software reviewers leaving their offices adopt the crouching run peculiar to heavily-armed people disembarking from Bell Hueys in open country.

Zaga Mission, slicing two quid off your average Commodore cassette software price, hovers somewhere between the genre of Choplifter and Zaxxon, but owes more to the latter, the screen display being a three-quarter 3D scrolling view of a Bomb Alley cluttered with convoluted brickwalls guaranteed to wreck your cyclic pitch.

Main carps about this program? You can't fly backwards — unlike a real rotorcraft — and it's kind of slow: you'd expect the inhabitants of planet Zaga to come up with something a little more nifty. For those with a destructive bent there are no fuel dumps to torch; nor can you do your soul good by winching distraught matchstick figures out of hostile territory.

Plusses? Great sound — turn the volume up and put your ear defenders on. The graphics are great too, but it is sometimes hard to figure out exactly where you are in relation to obstacles — the 'copter casts a shadow on the ground though, and



this helps a bit. The aerial manoeuvring faithfully reflects the tendency of early helicopters to swing or torque — so watch you don't bash your tail-rotor against a wall as you go round corners, or else it's DIK-DIK-DIK-KA-BOOM-SPLAT! (Technical term used by mature adult computer journalists while relaxing with a glass of Lucozade after picking over the finer points of a nice juicy piece of machine code.)

No saving, no slaughter — what then? The reason you are attempting these mazes is maybe to keep up your flight pay? No way, Jose — your goal is to reach the malfunctioning power plant that keeps planet Zaga 1 safe from harmful cosmic bombardment. As a result of the fault, security doors are opening and closing erratically — another hazard. You can gas up after each maze — but the limitations of your operational range are a further handicap in your attempt to save your world. A helicopter of a game.

Paul Bond

Drive-in

- *Spectrum*
- *Fantasy*
- *Arcade adventure*
- *£5.50*

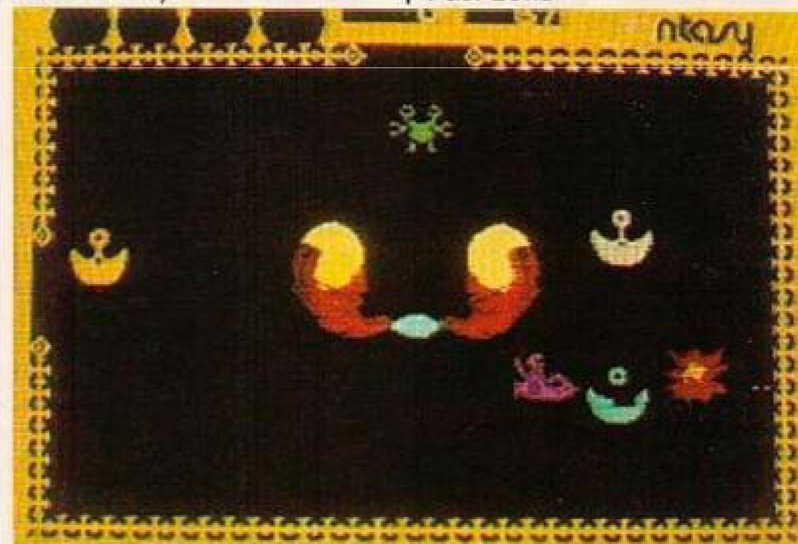
★ ★

GOOD STOCK Fantasy stuff — 189 screens, 28 different aliens and various objects to be collected. If this software house were a movie star it would be Clint Eastwood — there is a strict unvarying formula to all their products which must presumably be popular with the user.

This is one of those games where you have to reassemble your spaceship by collecting all the various bits. A slight twist is added by the fact that the central character — the one doing all the zipping about and zapping is a superheroine called Dezzy. Beautiful she may be but a big space suit and only a few pixels make it hard to tell.

What happened to Ziggy, the customary star of Fantasy games? Well, Dezzy is on her way to help him. Lured into an abandoned drive in by the villain of the piece she has to piece together an old starship to escape. This must be assembled in the correct sequence inside room 189.

You can use a joystick or keyboard



to control the character and there is a keyboard redefining option. You use keys 1-4 to pick up and drop objects when Dezzy is directly over them.

You can also score by shooting the aliens, of course, but when the points score reaches 10,000 it resets to zero and the percentage completed of the game increases. You don't just collect objects — you can also trade them for other objects and some of the rooms have automatic garages, banks and time machines. These can all be used to assist you complete the game. It's a little bit like a poor man's Atic Atac, but for people who like compiling maps and puzzling over functions of gadgets, I'm sure it'll be a great hit.

Paul Bond

Monty is innocent

- *Spectrum 48K*
- *Gremlin Graphics*
- *Arcade adventure*
- *£6.95*

★ ★

GREMLIN Graphics' character Monty first came to prominence in Monty Mole — a game which trod on a few nerves with its references to the miners' strike — especially in view of the fact that the author was the son of a pit safety officer.

In an attempt to redress the balance, we find Monty has been

(continued on next page)

Star★chart

Automan

CBM-64
Bug-byte
Platform and maze
£9.50
★ ★

One of a series of average games being boosted by a link with a TV series.

Below average quality graphics on the opening screen — a tedious platform game — dulled any enthusiasm aroused by the packaging. Quality of programs must improve, or home computers in the UK will go the way of the hula hoop.

Dam Buster

Oric-1/Atmos
IJK
Simulator
£8.50
★ ★ ★ ★

No micro can be considered complete without its very own flight simulator. This is the first program for the Oric/Atmos worthy of the name. While not up to the Spectrum/Commodore standards, it has all the usual features of maps, instruments and out-of-the-cockpit view.

The scenario is interesting, precision bombing, requiring tricky co-ordination of speed, height and position. Perhaps Oric/Atmos owners can look forward to further refinements of this. Aerobatics are out, and the landing process is rather abstract, instruments only.

Therbo

Spectrum 48K
Arcade
Shoot-'em-up
£5.50
★ ★ ★

A sort of cross between rollerball and American football, Therbo consists of protecting a ball from the computer which is trying to knock it into touch.

You have a large armoury — for a ball game at least — of missiles, mesmos and thrustas to help you guide the therbo up the field, and frustrate the computer's efforts to do the same. Nice graphics with sideways scrolling, and a tricky game to master.

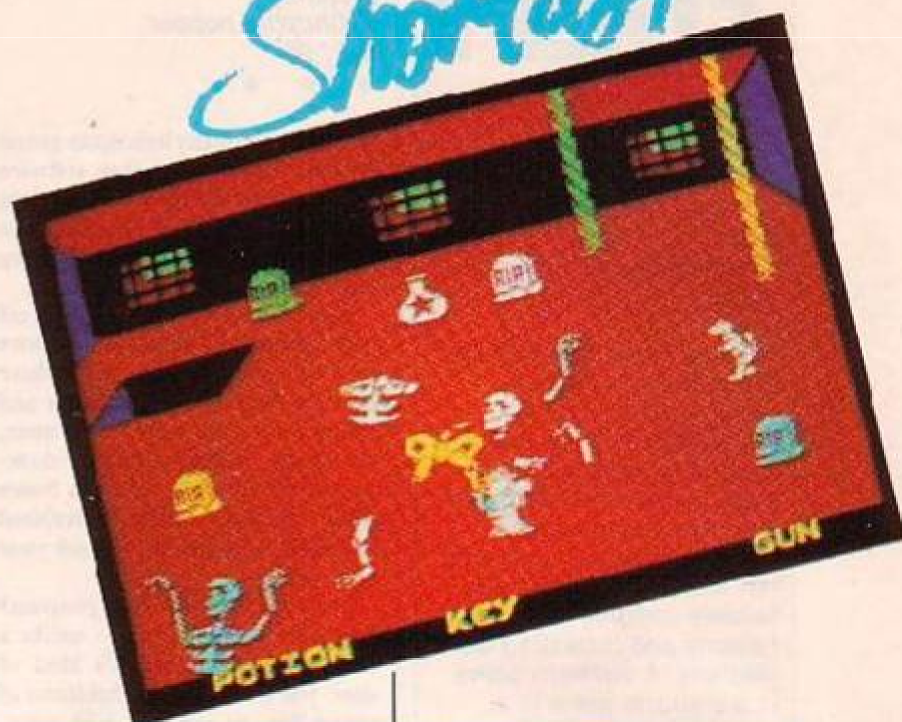
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reduced to stealing coal and has been imprisoned for this.

The aim of the game is for Monty to get the key from the prison governor's office and escape. He rushes around various screens being pursued by prison officers, ghosts and so on. He can move from screen to screen by rushing off the side sliding up and down ropes or by falling down holes.

Plenty of imagination has been used to create the backdrops — there are a couple of good 3D mazes and an ingenious sequence in a gymnasium. Money received from sales of Monty Mole was destined for donation to the Miner's Welfare Fund — though at the time of going to press, this body still had not made up its mind to accept the gift. The Miner's Welfare Fund is an established charity which existed prior to the strike. No such donations are planned this time.

A competent and graphically inventive game.
Paul Bond

SOFTWARE *Shortlist*





Gandalf

- *CBM-64*
- *Tymac*
- *Shoot 'em-up*
- *£9.95*

★ ★ ★

ONE WOULD have thought that a name like Gandalf would create a lot of copyright problems — upsetting the administrators of the Tolkien estate makes a visit from the Ringwraiths seem pleasurable by comparison.

Speculation apart, this is an ingenious game with very nice graphics. It has nothing whatsoever to do with the Lord of the Rings, apart from hijacking the old sorcerer's name.

The screen display shows a castle wall with two turrets. In the distance large T. Rex-style saurians are wiffling through the tulgey woods. These are in fact scaly-tailed lizard men keen to augment their schemes for financial investment by relieving you, Gandalf, of your treasure which is protected by the customary ancient spell, third party, fire and theft. In other words, it's wizards versus lizards.

The slimy reptiles intend to achieve their aim by abducting your apprentices and holding them for ransom. You can prevent this by directing lightning bolts down on the vile kidnappers. The joystick controls the movement of the wizard and the direction of his power. To direct the wizard's power you just move the cross-hairs around the screen and then press the firebutton. To move the wizard himself around you have to hold down the button and waggle the joystick. If your power drains you have to shift the necromancer up the shining tower sharpish and replenish his batteries from the shining star. There is a deadly spider knocking around behind the battlements and like most giant arachnids it leaves you feeling pretty sick if you bump into it.

Zapping the lizards turns them into gold coins. This is of crucial importance to the second screen since the waves of reptiles are so inexorable that sooner or later they are bound to get past the gate and make off with a member of your youth opportunities scheme.

Being a good employer you give chase, and set a power bolt trap in the path of the lizard man. When the trap destroys the lizard you can retrieve the apprentice by brushing against him and returning to the castle. Then you have to retrieve the trap. You can also collect the gold coins lying around. But as always — remember to watch out for the yellow ostrich — it will steal the coins. The best computer games always have a moral of some sort, and it's true that you won't go far wrong in life if you watch out for the yellow ostrich.
Paul Bond

Back Track

- *Dragon 32*
- *Incentive Software*
- *3D Maze Game*
- *£6.50*

★ ★ ★ ★

No, we haven't forgotten about the Dragon, but a lot of the software companies have.

This really does take the Dragon 32 to its limits. You are given an overhead view of one of the rooms with Eddie in the middle.

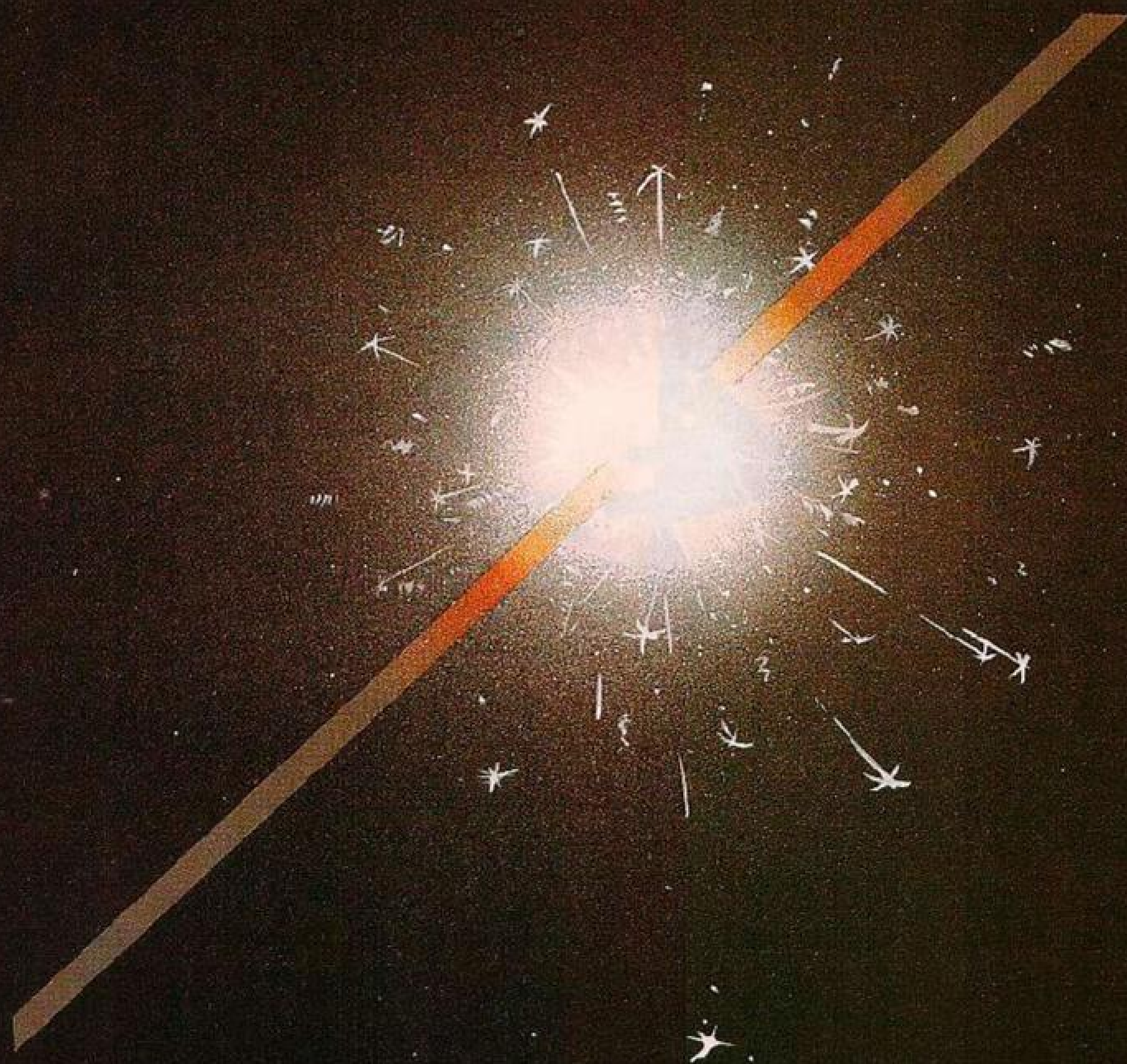
It transpires that Eddie is held captive by the mad professor who is cruelly plumbing the innermost depths of the human psyche. As a worse torture than watching endless re-runs of the Paul Daniels show, the professor has designed a series of five labyrinthine tests of increasing complexity to see if Eddie's will to live can be broken — his will to live is shown as a barometer on the left of the screen. Objects are automatically picked up as Eddie enters a room and his willpower is boosted. Eddie has to reach the exit, finding keys in the correct order before he can get out.

Pressing the M key displays a map — if Eddie has found it — and pressing any other key returns you to the main display.

Watch out for somewhat sleepy serpents and the prof's pet genetically-mutated rug, which objects to being walked on too much.

All in all, an enterprising effort by Chris Andrew and what a pity software companies didn't produce more of this kind of quality software before the Dragon had the rug pulled from under it.
Paul Bond

CONFUZION



INCENTIVE

NEWS

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The crystal ball

MSX micro owners — rejoice! Level 9 Computing have made all of their celebrated adventures available on cassette for your micro. Priced at £9.95 each, such superb games as Colossal Adventure, Adventure Quest, Dungeon Adventure, Lords Of Time, Snowball and Return to Eden can now be played on your new MSX. You can't call yourself an adventurer until you've experienced one of Level 9's programs. Worth buying an MSX for.

Rather than use scruffy old pages torn out of a school rough book, you could do no better than invest £3.95 in a pad of 50 Adventure Planner sheets from Print N' Plotter Products. Each large sheet is high quality paper preprinted with 150 interconnecting location boxes.

The sheets are ideal for designing your own adventurers or keeping an impressive permanent record of a completed game. Excellent value.

A helping hand

Adventure International's Sorcerer of Claymorgue Castle is obviously giving quite a few of you adventurers a lot to think about. Once again, Scott Adams' mischievous mind has caused the heavens to ring with pleas for help. Here's a morsel of assistance:

Can't get up to the loft in the ballroom?
LLEPS THGIL TSAC NEHT REILEDNAHC NELLAF NO DNATS
Nothing useful in the kitchen?
STENIBAC EHT NI KOOL A EVAH
Haven't met the dragon yet?
NWOD HSUP DNA MOOR NIALP OT OG
Yours in castles and caverns.
HUGO NORTH

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.



King Arthur's Quest

48K Spectrum
£7.95
Hill MacGibbon

KING ARTHUR'S QUEST is a graphics and text adventure that takes you through Camelot, currently under Morgana's wintry spell.

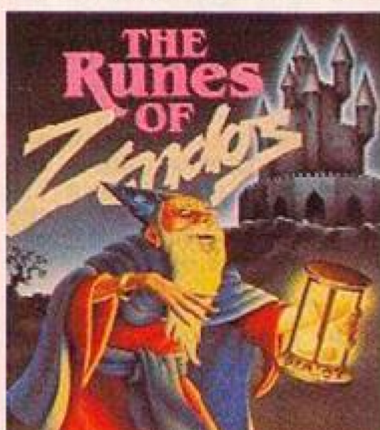
The land is split into eight areas: Merlin's Tower — where you start, the wilderness, enchanted forest, keep, chapel, crypt, cavern and Morgana's Castle. Each area is based on a grid of 10 by 10 squares.

Every time you move, you progress one square and are presented with a forward view of the surrounding area. Permanently on view are Excalibur which slowly turns red as your life-force diminishes and a picture of every object in your possession.

The bottom of the screen is used as a scrolling text window, recording your commands and allowing Grymalkin the cat, your faithful companion, to furnish information on objects, incidents, etc.

Commands are given by single-key entries. You don't have to memorise them — a keyboard overlay is provided. There are only eight actions you can perform: turn left or right, move forward, take, leave or use an object, eat/drink and cast a spell. You can also repeat a description, cancel a command, save and restore a game.

Among the characters you'll encounter are a jester, griffin, and owl. Characters may help you — if you help them. The graphics are simple but effective and the text characterset has been designed to look like authentic manuscript. Some sound effects have been included. An enjoyable game of exploration and discovery for the younger adventurer.



Runes of Zendos

48K Spectrum
£7.95
Dorcas Software

ZENDOS IS AN animated graphics and text adventure with some similarities to its predecessor, Oracle's Cave. If you liked that, then chances are you will enjoy this one.

The screen is divided into two, the top half displaying a side-on view of part of a room which scrolls horizontally or vertically in response to your chosen movement. The lower half is used for textual commands and responses. Commands can range from the terse — l for go left — to the verbose — attack the guard with the mighty axe.

You are shown as a small white-clad figure whose mission it is to seek out and destroy the wicked wizard Zendos. He has separately imprisoned the spirit of each month — you must find and release all 12 spirits. Each section of the castle is split into several chambers.

Since each of the spirits is located in a different section, the program kindly lets you move instantaneously from section to section with a single command. Effectively, you get to play 12 connected sub-adventures.

Apart from your own walkabouts, the animation mostly comes from simply stylised battles with many of the characters you meet. These characters, as in Oracle's Cave, are solidly presented and imaginatively designed. As well as fighting, cracking runic codes and casting spells are other major activities.

As an animated adventure, Zendos works out very well. If you want a change from text only adventures, this should fill the bill.

Project-X the micro man

48K Spectrum
£3.25
Compass Software

A NOVEL and enjoyable Quilled adventure. An accident has miniaturised you and the quest concerns your attempts to return to normal. You'll battle with a mole — but what, given your diminutive dimensions, will you use for weapons? Over 150 locations, 80 objects and original puzzles ensure good value for money.

The Legacy

48K Spectrum
£7.95
Tamsoft

ANOTHER QUILL-BASED adventure, your eccentric grandfather has died and named you as sole beneficiary. To claim your inheritance, you must first find the secret vault by following a treasure trail of clues left by grandpa. A non-violent, pleasantly stretching text adventure.

SPACE JUNK

Listing 1.

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100 REM***** SPACE JUNK PRE-LOADER ****
110 REM** COPYRIGHT 1985 NALIN SHARMA *
120 REM**  ALL RIGHTS FOR SPACE JUNK  *
130 REM**  RESERVED BY NALIN SHARMA   *
140 REM*********************************
5000 FORX=0TO35
5010 READA
5020 POKE49152+X,A
5030 NEXT
5040 SYS49152
5990 REM**M/C DATA TO LOAD MAIN FILE**
6000 DATA169,1,162
6010 DATA1:REM**CHANGE TO 8 FOR DISK**
6020 DATA160,1,32,186,255,169,10,162,26
6030 DATA160,192,32,189,255,169,0,32
6040 DATA213,255,76,0,64,83,80,65,67
6050 DATA69,32,74,85,78,75
```

Nalin Sharma with the first part of a joystick-only game.

SPACE JUNK is a fast, all action, machine-code game for the Commodore 64. It features ultra-smooth movement of all graphics, including the fine scrolling of the planet surface.

The basic idea of the game is to move your spaceship across the planet and retrieve 32 satellites which litter the skies. However, it is not very easy as there are four junkies patrolling the planet and touching them is fatal.

The game is 30K long so it is being published in three parts. To enter the program you will need to type in three listings — listing 3 being the first block of object code for Space Junk. It would be sensible to use three different cassettes — call them X, Y and Z. It is imperative that cassettes Y and Z are C30.

If you are working with disc, change the following:

Line 6010 in listing 1 as instructed.
Lines 2015 and 3015 as instructed, in listing 2.

If you do not feel up to typing the program in, then if you send me £3.25 — cheques/P.O.s payable to Nalin Sharma — together with your name and address I will be happy to send you a copy of Space Junk on a fast loader. Send to: Nalin Sharma, 35 Kitchener Road, Walthamstow, London E17 4LJ.

First of all, type in listing 1 and save it on cassette Z, but after saving it do not rewind the tape, as later the object code must follow it. Listing 1 is the pre-loader for Space Junk. So all it does is set up the kernal to load the object code file — once loaded it will be executed and the game will begin.

Now, before typing in listing 2, you must move the start of Basic upwards as follows:

POKE 32768,0	(RETURN)
POKE 44,128	(RETURN)
POKE 43,1	(RETURN)
NEW	(RETURN)

Now type in listing 2 and save it on cassette X. Listing 2 is the code-aid which will allow you to enter the object code. It is important that before loading or using listing 2, the start of Basic is moved as shown above.

Once you have checked listing 2 and you have saved it, you can begin to enter the object code — listing 3. So type Run and press Return and you should see a three-option menu, provided that listing 2 has been entered correctly. The menu is as follows:

1 = ENTER CODE
2 = LOAD CODE
3 = SAVE CODE

After pressing 1 you will be asked from which hex address you wish to start entering the code. This means that you don't have to enter all the code at once — you would be better off typing in only a few hundred lines a day. So if you haven't entered any Space Junk code previously, type in 0800 and press Return. Now the computer will print "0800?" and will await the entry of the line of code. You *don't* have to type in the hex address every time you enter a line.

When entering a line of code, type in the first 16 characters which represent eight bytes of code, then a space, and then the last three characters which represent a checksum of those eight bytes of code. Once you have typed in the line, press Return and provided that the line has been entered correctly, the computer will print "OK" and will go on to the next hex address automatically. If the line has not been entered correctly, the computer will print "TRY AGAIN" and you'll have to re-enter the line.

This system of checking the code as it is entered is very efficient, and it will vastly improve the chances of the program running first time. If at any time you wish to return to the menu, to save the code so you can return to it at a later date, instead of entering a line of code press "*" and then Return.

Option 2 allows you to load in previously saved code. Make sure that your disc/cassette is ready and then press "2". The code will now be loaded. Option 3 allows you to save the object code. Just make sure that your disc/

(continued on page 48)

Listing 3.

```
0800: 007CE6F6DECEC67C 546
0808: 001878181818187E 16E
0810: 007CC6067CC0C6FE 448
0818: 007CC6063C06C67C 2CC
0820: 00C6C6C67E060606 2E2
0828: 00FEC0C0FC06C67C 4C2
0830: 007CC6C0FCC6C67C 506
0838: 00FE060C18303030 1B8
0840: 007CC6C67CC6C67C 48C
0848: 007CC6C67E06C67C 3CE
0850: 00000000FE000000 0FE
0858: 000000FEFEFE0000 2FA
0860: 0000FEFEFEFEFE00 4F6
0868: 00FEFEFEFEFEFEFE 6F2
0870: 007CC6DEC6F6C67C 51E
0878: 0000C0F8FEF8C000 46E
0880: FFFDF5DDFDFDD5FF 79C
0888: FF7F7F7F7F7F57FF 4D0
0890: FFF5DFFFF5DFD5FF 770
0898: FF5FF7F75FFF57FF 600
08A0: 000000FFFF000000 1FE
08A8: 3C3C3CFFFF000000 2B2
08B0: 3C3C3C3C3C3C3C3C 1E0
08B8: FFEFEBEEEFEFFFFC 7A0
08C0: FFEEEEEEAFEEFF00 665
08C8: FFAAFFAAFEAAFF00 5F9
08D0: FFFFFFFFCFCFFF00 699
08D8: FF033F03F303FF00 339
08E0: FF0333033F3FFF00 2B5
08E8: FF0333033333FF00 29D
08F0: FF033F3F3F03FE0A 2CA
08F8: FF033F0F3F03AAAA 2E6
0900: 0000000000000000 000
0908: FF03CFCFCF0FBFA0 4DD
0910: FF3333333303FF00 2CD
0918: FF0333333333FF00 2CD
0920: FF33330F3333FF00 2D9
0928: FFFEFEFECECEFF00 694
0930: FFFEBEEEFAFEFF00 6A0
0938: FFEAEFEAFFEAFF00 6AA
0940: FFAFFFAFEFAFFF3F 638
0948: 00020AFFFF000000 20A
0950: 00AAAAFFFF000000 352
0958: 0050A0FFFF000000 31E
0960: FFFFFFFFFFFFAAAA 74E
0968: FFFFFFFFFFFFFFFF 7F8
0970: 0000000000001818 030
0978: 7E9999FFFF99997E 55E
0980: 7EF3939FF9C9CF7E 5B2
0988: 7EE7E79999E7E77E 5CA
0990: 7ECFC9F99F93F37E 5B2
0998: 7EE7E79F9FFFFF7E 6A6
09A0: 7EFFFF9F9FE7E77E 606
09A8: 7EFFFFF9F9E7E77E 6BA
09B0: 7EE7E7F9F9FFFF7E 6BA
09B8: 7EFFE7C7CFFFFF7E 676
09C0: 7EFFFFE7E7FFFF7E 6C6
09C8: 7EFFFFF3E3E7FF7E 6B6
09D0: 0000181800181800 060
09D8: 001C30303030381C 138
09E0: 0070381818183870 198
09E8: 0000007E007E0000 0FC
09F0: 0000000000000000 000
09F8: 0000000000000000 000
0A00: 7EC3DBDFDFDBC37E 3F6
0A08: 007CC6C6FEC6C6C6 558
0A10: 00FC66667C6666FC 40C
0A18: 007CC6C0C0C0C67C 4C4
0A20: 00FC6666666666FC 3F6
0A28: 007EC0C0FCC0C07E 4F8
0A30: 007EC0C0FCC0C0C0 53A
0A38: 007CC6C0DEC6C67C 4E8
0A40: 00C6C6C6FEC6C6C6 5A2
0A48: 00FC3030303030FC 2E8
0A50: 007E181818D8D870 2E6
0A58: 00C6CCD8F0D8CCC6 5A6
0A60: 00C0C0C0C0C0E07E 51E
0A68: 00C6EEFEFED6C6C6 5DA
0A70: 00C6E6F6FEDECEC6 612
0A78: 007CC6C6C6C6C67C 4D6
0A80: 00FCC6C6FCC0C0C0 5C4
0A88: 007CC6C6C6D67C06 426
0A90: 00FCC6C6FCD8CCC6 5EE
0A98: 007CC6C07C06C67C 3C6
0AA0: 00FC303030303030 21C
0AA8: 00C6C6C6C6C6C67C 520
0AB0: 00C6C6C6C6C66C38 492
0AB8: 00C6C6C6D6FEEEC6 53A
0AC0: 00C6EE7C387CEEC6 498
0AC8: 00C6C6C67E06C67C 418
0AD0: 00FECE1C3870E6FE 474
0AD8: FFFEFEFECFCEFF00 695
0AE0: FFAAFFAFFEAAFF00 5F9
0AE8: FFEFEFEFEFEAFF00 6A4
0AF0: FFFFFFFFFEFAFF3F 638
0AF8: 000000C0C0000000 180
0B00: 0000003030000000 060
0B08: 0000000C0C000000 018
0B10: 0000000303000000 006
0B18: 000000000000FFFF 1FE
0B20: 00000000FFFF0000 1FE
0B28: 0000FFFF00000000 1FE
0B30: FFFF000000000000 1FE
0B38: 006CFEFEFE7C3810 42A
0B40: 7ECF8D9999B1F37E 52E
0B48: 7EC3879FF9E1C37E 582
0B50: 7EC381FFFF81C37E 582
```





Listing 2.

```
10 REM*** SPACE JUNK CODE-AID ***
20 REM*** COPYRIGHT 1985 NALIN SHARMA ***
90 GOSUB4000
100 POKE53280,3:POKE53281,1
110 PRINT"        * SPACE JUNK CODE AID *"
115 PRINT"           * O P T I O N S *"
120 PRINT"           1 = ENTER CODE"
130 PRINT"          2 = LOAD CODE"
140 PRINT"          3 = SAVE CODE"
150 GETV$:IFV$=""THEN150
160 V=VAL(V$):IFV<1ORV>3THEN150
170 ONVGOSUB300,2000,3000
180 GOTO100
300 REM *** ENTER CODE ***
310 INPUT"PLEASE ENTER START IN HEX";H$
320 IFLEN(H$)<>4THEN310
330 GOSUB1200
340 DA=DT:PRINT""
350 D=DA:GOSUB1000:REM*********PRINT HEX ADDRESS*
360 PRINTH$;:INPUTHX$:REM*******GET HEX LINE*
365 IFHX$="*"THENRETURN:REM***TO EXIT**
370 IFLEN(HX$)<>20THEN360:REM*CHECK LENGTH
380 LNT=0:FORP=1TO15STEP2:REM*BREAK DOWN*
390 H$=MID$(HX$,P,2):REM*******GET BYTE*
400 GOSUB1200:LNT=LNT+DT:REM*****ADD CHECKSUM*
410 POKEDA,DT:DA=DA+1:REM******POKE& NEXT LOC *
420 NEXTP
430 H$="0"+MID$(HX$,18,3):REM*****FIND CHECKSUM
440 GOSUB1200
450 IFDT<>LNTTHENPRINTTAB(29)"TRY AGAIN":DA=DA-8:GOTO350:REM*LINE CHECKSUM*
460 PRINTTAB(29)"OK":IFDA=31088THENPRINT"FINISHED!!!":FORDE=1TO500:NEXT:RETURN
470 GOTO350:REM**END OF LOOP***
1000 REM *** DEC-HEX ***
1010 DD=D:H$=""
1020 IFD=0THENRETURN
1030 IFD>65535ORD<0THENRETURN
1040 FORI=3TO0STEP-1
1050 Z=D/(16^I)
1060 IFZ<1THENH(I)=0:GOTO1080
1070 H(I)=INT(Z):D=D-(H(I)*(16^I))
1080 IFH(I)>9THEN1110
1090 H$=H$+CHR$(H(I)+48)
1100 GOTO1120
1110 H$=H$+CHR$(H(I)+55)
1120 NEXT
1130 RETURN
1200 REM *** HEX-DEC ***
1210 DT=0
1220 IFH$="Z"THENPRINT"FINISHED":RETURN
1230 HL=LEN(H$)
1240 IFHL>4THEN1200
1250 FORI=HLTO1STEP-1
1260 A=ASC(MID$(H$,I,1))
1270 IFA>60THEN1300
1280 A=A-48
1290 GOTO1310
1300 A=A-55
1310 DT=DT+(A*(16^(HL-I)))
1320 NEXT
1330 RETURN
2000 REM***LOAD CODE***
2005 PRINT"LOADING CODE"
2010 POKE780,1:POKE782,1
2015 POKE781,1:REM**CHANGE TO [ POKE 781,8 ] FOR DISK**
2020 SYS65466
2030 POKE780,13:POKE781,0:POKE782,192
2040 SYS65469
2050 POKE780,0:POKE781,0:POKE782,0
2060 SYS65493
2070 RETURN
3000 REM***SAVE CODE***
3005 PRINT"SAVING CODE"
3010 POKE780,1:POKE782,1
3015 POKE781,1:REM**CHANGE TO [ POKE 781,8 ] FOR DISK**
3020 SYS65466
3030 POKE780,13:POKE781,0:POKE782,192
3040 SYS65469
3050 POKE251,0:POKE252,8:POKE780,251
3060 POKE781,200:POKE782,123
3070 SYS65496
3080 RETURN
3990 REM***PUT DOWN FILE NAME IN MEM***
4000 N$="SPACE JUNK"
4010 FORN=1TOLEN(N$)
4020 POKE49151+N,ASC(MID$(N$,N,1))
4030 NEXT
4040 RETURN
```

```
0B58: 7EC3E1F95F87C37E 552   0C30: FF83393F03393983 2F2   0D08: 0202010101010103 00C   0DE0: C0F03C3CF0F03C3C 480
0B60: 7EF3B19959BDCF7E 52E   0C38: FF01F9F3E7CFCFCF 640   0D10: A0A05053505050F0 3C0   0DE8: 0F3FF0F0FFFFF0F0 60C
0B68: 7EDB99999999DB7E 516   0C40: FF83393983393983 35C   0D18: 0303030302020202 014   0DF0: FFFF0000FFFF0000 3FC
0B70: 0000000200000000 000   0C48: FF83393981F93983 42A   0D20: F0F0F0F0A0A0A0A0 640   0DF8: C0F03C3CFCFC3C3C 498
0B78: 0000000200000000 000   0C50: 0F3FF0F0F0A0AA2A 492   0D28: 2F15151515050100 084   0E00: 000000FFFF000000 1FE
0B80: 0000000200000000 000   0C58: C0F03C3C00000000 040   0D30: 0201015555555500 158   0E08: FF83393901393939 2A0
0B88: 0000000200000000 000   0C60: 0A00005050150500 0C4   0D38: A250505050504000 270   0E10: FF03999983999903 3EC
0B90: 0000000200000000 000   0C68: A828141414504000 19C   0D40: F0F0F0F0F0A0A0A0 690   0E18: FF83393F3F3F3983 334
0B98: 0000000200000000 000   0C70: FFFFF0F0F0A0AAAA 6C2   0D48: 3C3C3C3C3C282828 1A4   0E20: FF03999999999903 402
0BA0: 0000000200000000 000   0C78: F0FC3C3C3C28A8A0 410   0D50: A2A0505050551500 29A   0E28: FF813F3F033F3F81 300
0BA8: 0000000200000000 000   0C80: A0A0505050505000 2D0   0D58: 2828141414545000 130   0E30: FF813F3F033F3F3F 2BE
0BB0: 1010101010101010 080   0C88: 0F3FF0F0F0A0AAAA 512   0D60: F0F0F0FCFCAAAAAA 6C6   0E38: FF83393F21393983 310
0BB8: 000000FF00000000 0FF   0C90: C0F03C3C3C28A8A8 3DC   0D68: 3C3C3C3C3C2828A8 224   0E40: FF39393901393939 256
0BC0: 000000F010101010 130   0C98: A0A0505050505000 2D0   0D70: A2A2505050505000 2D4   0E48: FF03CFCFCFCFCF03 510
0BC8: 0000001F10101010 05F   0CA0: 2828141414141400 0B4   0D78: AEA8545414141400 234   0E50: FF81E7E7E727278F 512
0BD0: 101010F000000000 120   0CA8: 0F3FF0F0F0A0A0A0 4FE   0D80: F0F0F0F0F0A2AAAA 6A6   0E58: [illegible] 250
0BD8: 1010101F00000000 04F   0CB0: C0F03C3C00000000 228   0D88: 3C3C3C3C78A08000 288   0E60: FF3F3F3F3F3F1F81 2DA
0BE0: 00663CFF3C660000 243   0CB8: A0A0505050150500 24A   0D90: AFA2505050505000 2DC   0E68: FF39110129393939 21E
0BE8: 0000000000000000 000   0CC0: 0000001414504000 0B8   0D98: 8EA0041414141400 1C4   0E70: FF39190901213139 1E6
0BF0: FF818181818181FF 504   0CC8: 3FFFF0F0F0A0AAAA 502   0DA0: 0F3FF0F0FFFFF0F0 60C   0E78: FF83393539393983 322
0BF8: FFC3A59999A5C3FF 600   0CD0: F0FC00000000A0A0 32C   0DA8: FFFF0000FFFF0000 3FC   0E80: FF033939033F3F3F 234
0C00: FF83312109193983 2B2   0CD8: A0A0505050551500 29F   0DB0: C0F03C3CFCFC3C3C 498   0E88: FF833939392983F9 3D2
0C08: FFE787E7E7E7E781 68A   0CE0: 0000000003545000 0A4   0DB8: F0F0F0F0F0F03F0F 5EE   0E90: FF03393903273339 20A
0C10: FF8339F9833F3901 3B0   0CE8: 0F3F3F0F00000000 09C   0DC0: 000000000000FFFF 1FE   0E98: FF83393F83F93983 432
0C18: FF8339F9C3F93983 52C   0CF0: FFFFFFFF03020202 405   0DC8: 3C3C3C3C3C3CF0C0 318   0EA0: FF03CFCFCFCFCFCF 5DC
0C20: FF39393981F9F9F9 516   0CF8: FFFFFFFF20A0A0A0 5CC   0DD0: FFFFF0F0FFFFF0F0 7BC   0EA8: FF39393939393983 2D8
0C28: FF013F3F03F93983 336   0D00: F0FCFCF000000000 3D8   0DD8: FFFF0000FFFF0000 3FC
```

(listing 3 continued on next page)



(continued from page 46)

cassette is ready and then press "3". The code will now be saved.

Use cassette Y to save the object code until you have finished typing all of it in. Then you can save it after listing 1 on cassette Z. This should then give you a complete copy of Space Junk. It can now be loaded in the normal Shift and Run/Stop way, and hopefully it should load and run perfectly. ■

See next month's issue for the second part of Space Junk.

(listing 3 continued from previous page)

```
0EB0: FF393939393983C7 366    1150: .0007000700070007 01C    13F0: 0000000000000000 000    1698: FF1FFFF0FF1CFFFF 630
0EB8: FF39393929011139 21E    1158: 0080008000800080 200    13F8: .0000000000000000 000    16A0: FF38FFFFFFC1FFFF 6F3
0EC0: FF391183C7831139 360    1160: F=D7D7D7D7D7FFFF 730    1400: 0000FFFFFFC7C7C7 552    16A8: 6060000000000000 0C0
0EC8: FF39393981F93983 3E0    1168: F-FFD7D7D7D7D7FF 730    1408: FFFFFFFF8F8F8FFFF 7E3   16B0: 0606000000000000 00C
0ED0: FF0131E3C78F1901 384    1170: 8F8F000000000000 11E    1410: E3E3E3FFFF=FFFFF 734    16B8: 00000000000000FF 0FF
0ED8: 0000000000000000 000    1178: F1F1000000000000 1E2    1418: FFFF1F1F1F=FFFFF 558    16C0: 00000000000F=FF00 1FE
0EE0: 0000000000000000 000    1180: FFC0C0E8E8E8E8FF 71E    1420: 0000001818001818 060    16C8: 000000FFFFF=0000 2FD
0EE8: 0000000000000000 000    1188: FC0C0C0C0C0C0CFC 240    1428: 000000081C080000 02C    16D0: FF8383838383FF00 48D
0EF0: 0000000000000000 000    1190: FFFFE77EFF9FFFF9 6F9    1430: 0000001818000000 030    16D8: FFC1C1C1C1C1FF00 5C3
0EF8: 0000000000000000 000    1198: FF7CFFE3FF78FFFF 6D2    1438: FFFF3FFF3F3F3FFF 4F8    16E0: 0000000000000000 000
0F00: 0000000000000000 000    11A0: FF1CFFFFFFE0FFFF 6F6    1440: 00001C22270B1017 097    16E8: 0000000000000000 000
0F08: 0000000000000000 000    11A8: 0303000000000000 00E    1448: 0000708BE0100000 1E8    16F0: 0000000000000000 000
0F10: 00000000FFFFFFFF 3FC    11B0: C0C0000000000000 180    1450: 0007000300030007 014    16F8: 0000000000000000 000
0F18: FF00000000F0F0F0 0FF    11B8: 00000000FF000000 0FF    1458: 0080000C000C0080 280    1700: 0000FFFFFF3E3E3E 3B7
0F20: 00000000000000FF 0FF    11C0: FFFF000000000000 1FE    1460: FFD7D7FFD7D7D7FF 730    1708: F8FFFFFFFFFFF8F8 7E3
0F28: C0C0C0C0C0C0C0C0 600    11C8: 00FFFFFF00000000 2FD    1468: FFD7D7D7FFD7D7FF 730    1710: 7C7C7CFFFFFFFFFF 66F
0F30: CCCC3333CCCC3333 3FC    11D0: FFC1C1C1C1C1FF00 5C3    1470: F1F1000000000000 1E2    1718: 1F1FFFFFFFFFFF1F 558
0F38: 0303030303030303 018    11D8: FF8383838383FF00 48D    1478: 8F8F000000000000 11E    1720: 000000FFFF001818 22E
0F40: 00000000CCCC3333 1FE    11E0: 0000000000000000 000    1480: FFC0C0C0C0C0C0FF 67E    1728: 000000081C080000 02C
0F48: FFFFFFF8F0E0C080 701    11E8: 0000000000000000 000    1488: FCACACACACACACFC 4C0    1730: 0000183C3C180000 0A8
0F50: 0303030303030303 018    11F0: 0000000000000000 000    1490: FFFFFCCFFFF3FF3F 6F9    1738: FFFF3FFF3F3F3FFF 4F8
0F58: 181818181F181818 0CE    11F8: 0000000000000000 000    1498: FFF1FF8FFFE1FFFF 75C    1740: 00000F1007081013 051
0F60: 00000000F0F0F0F0 03C    1200: 0000-FFFFFF1F1F1 5D0    14A0: FF0EFFFFFF70FFFF 678    1748: 00001AA4FAD80404 27C
0F68: 181818181F000000 085    1208: FFF8F8F8FFFFFFFF 7E3    14A8: 1818000000000000 030    1750: 0007000F000F0007 02C
0F70: 000000F8F8181818 233    1210: 8F8F3FFFFFFFFFFF 6A8    14B0: 1818000000000000 030    1758: 0080000000000080 100
0F78: 000000000003FFFF 1FE    1218: FFFF=FFF1F1F1FFF 358    14B8: 000000000000FF00 0FF    1760: FFD7D7D7D7D7D7FF 700
0F80: 0000001F1F181818 085    1220: 0000303C3C001818 0A8    14C0: 000000FFFF000000 1FE    1768: FFD7D7D7D7D7D7FF 700
0F88: 181818FFFF000000 245    1228: 0000300800000000 008    14C8: FFFF0000000000FF 2FD    1770: 3E3E000000000000 07C
0F90: 000000FFFF181818 245    1230: 0000301813000000 030    14D0: FF8989898989FF00 4AB    1778: 7C7C000000000000 0F8
0F98: 181818F8F8181818 280    1238: FFFF3FF33F333FFF 4E0    14D8: FF91919191=91FF00 4D3   1780: FFCACACACAC0C0FF 6A5
0FA0: C0C0C0C0C0C0C0C0 600    1240: 00001E210F112027 0A6    :4E0: 0000000000000000 000    1788: FC0C0C0C0C0C0CFC 240
0FA8: E0E0E0E0E0E0E0E0 700    1248: 00003048C0B000A08 'F8   :4E8: 0000000000000000 000    1790: FFFF9FF9FF7EFFE7 6F9
0FB0: 10FF00FF00FF00FF 40C    1250: 0007000300030007 014    :4F0: 0000000000000000 000    1798: FFC7FF3EFF8/FFFF 687
0FB8: 00FF00FF00FF00FF 3FC    1258: 0080000C000C0080 280    :4F8: 0000000000000000 000    17A0: FF07FFFFFF33FFFF 639
0FC0: 00FF00FF00FF00FF 3FC    1260: FFD7D7D7D7FFD7FF 730    :500: 0000F=FFFF8F8F8F 4AA    17A8: C0C0000000030000 180
0FC8: 00FF00FF00FF00FF 3FC    1268: FFD7=FFD7D7D7D7FF 730   :508: FFFFF=FFF8F8F8FF 7E3    17B0: 0303000000000000 005
0FD0: 00FF00FF00FF00FF 3FC    1270: C7C7000000003000 18E    :510: F1F1F1FFFFFFF=FF 7CE    17B8: 00000000000000FF 0FF
0FD8: 00FF00FF00FF00FF 3FC    1278: E3E3000000003000 1C6    :518: FF1F1=1FFFFFF=FF 558    17C0: 000000000003FFFF 1FE
0FE0: 00FF00FF00FF00FF 3FC    1280: FFC0C0CACACACAFF 6A6    :520: 0000003C3C001818 0A8    17C8: 000000000000FF=FFFF 2FD
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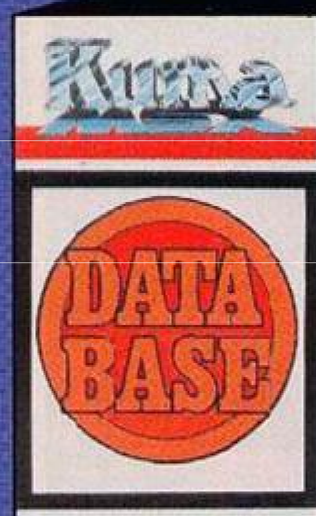

Eric and the Floaters


Binary Land

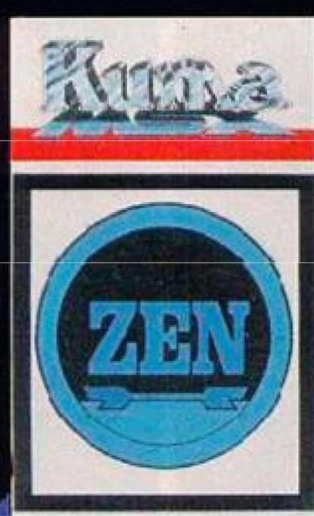

Driller Tank


Fire Rescue


Hyper Viper



Database



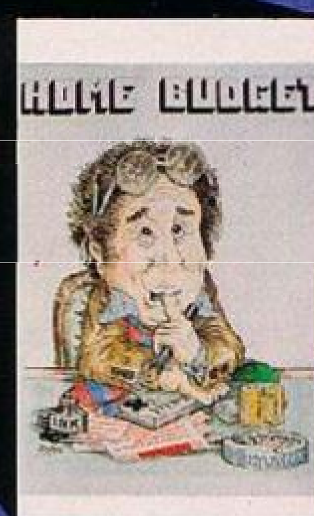
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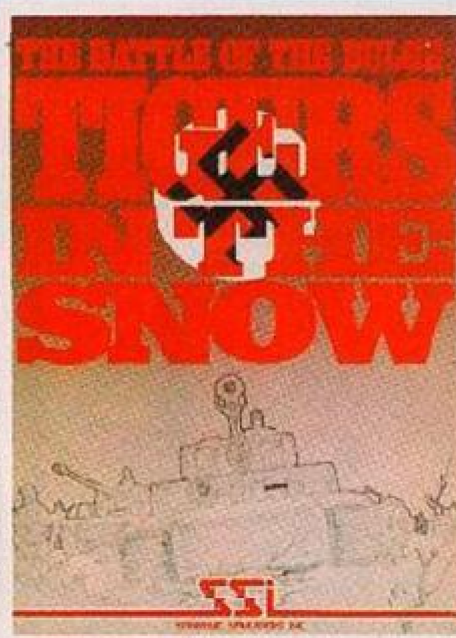
BATTLE FOR NORMANDY commences on 'D-Day' June 6th 1944 and relives the Allied Forces attempt to smash Hitler's Atlantic Wall.

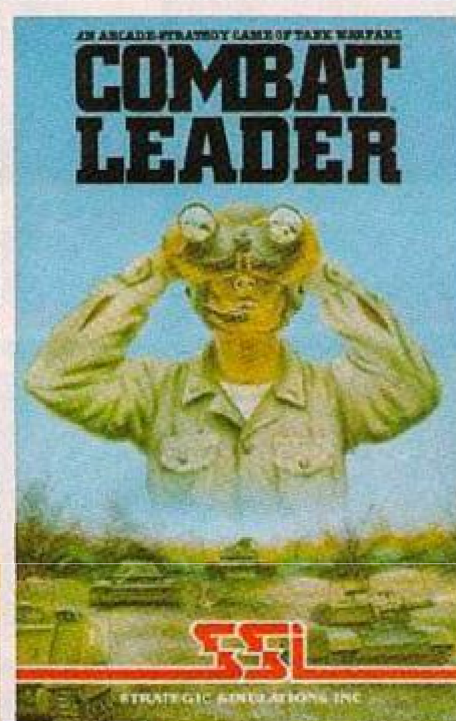
TIGERS IN THE SNOW reconstructs the legendary Battle of the Bulge as in December 1944 the Panzer Divisions of Von Rundstedt try one last gamble in a desperate attempt to halt Eisenhower's advancing Allied lines.

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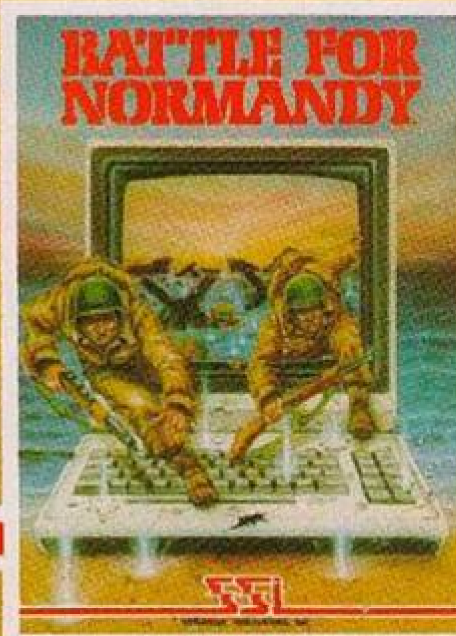
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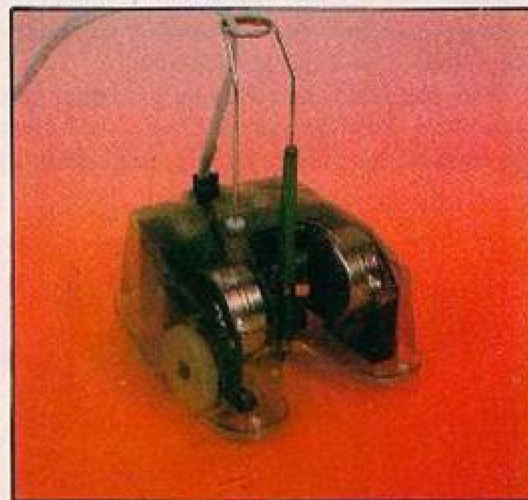
DESIGN A ROBOT *Competition*

WIN

Maplin's fabulous Hero Jr — the £1,100 literally all-singing, all-dancing robot.



Here's the chance to design the robot of your dreams — or nightmares. What we would like you to do to win a £1,100 Hero Jr or Zero II is to send us designs for your ideal robot. You can submit rough sketches, drawings or fully documented designs. Your robot could be for domestic, computer, medical or industrial use — or any other applications you can think of. We shall be publishing the best of the bunch in June.



PLUS

Two Maplin's Zero II mini-turtles for the runners-up.

RULES

- The winners of the competitiion will be the people who, in the view of the editor, come up with the most useful, original or witty designs for a new robot.
- The names of the winners will be printed in the June issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in March 1985.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of Business Press International or their relatives may enter the competition.
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Nigel Clark shows you how to join the robot revolution for as little as £10 or as much as £1,000.

FOLLOWING IN THE footsteps of the micro revolution another branch of high technology is preparing to invade the home — personal robots.

There are growing numbers of people on both sides of the Atlantic who believe that a BBC B should never be seen without its Buggy or Beasty arm, that the best use for an Apple IIc is to control Topo or that a ZX-81 is useless without a Hebot II.

It is often said that the personal robot market is at the same stage as the personal computer market was six years ago. It would be a mistake, however, to assume that it will follow the same growth path.

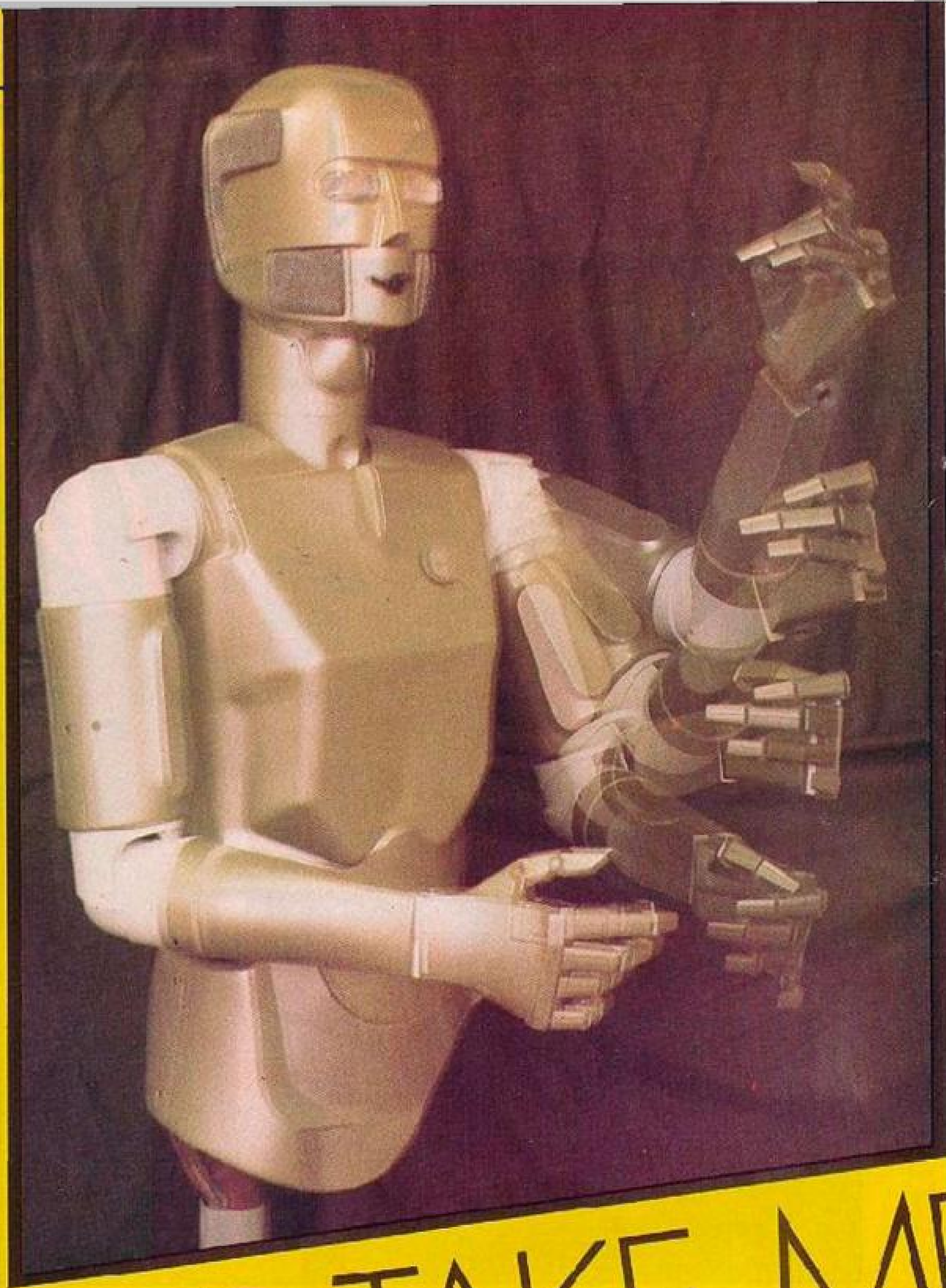
Computers are a relatively recent development and people have had little time to get fixed ideas about how they should look and of what they should be capable. Robots have existed in people's imaginations for centuries as humanoids who can do all these menial tasks we would rather not do. Anything that does not meet those requirements is seen as a failure.

Two American companies tried to meet the specifications halfway. Androbot built Topo which was imported into Britain for a short time by Prism Microproducts, costing £1,549.95, and RB Robots built the RB5X.

Both were capable of movement and speech and the RB5X was able to detect obstacles and avoid them. Both companies have had to apply for the American version of receivership.

The experience has not deterred them though. Both are still trading and Androbot has released another robot and another more complex version of Topo is due soon.

And one American company has been quite successful. Heathkit makes Hero 1 and Hero Jr and both are sold in Britain, in kit form by



ROBOTS TAKE M

Maplin Electronic Supplies and ready built by Zenith Data Systems.

Heathkit followed a different course to the others by emphasising the educational aspects of Hero rather than the fun robot image of the others. Costing about £1,600 in kit and £2,500 ready-built, Hero provides a single arm and single wheel driving system and the ability to control these in response to its five senses.

Hero Jr was launched towards the end of last year. It is being sold as a companion robot which can speak, sing, recite poetry and guard the house. All this comes for a price of £1,100.

While America was following the highly expensive personal robot route British developers saw a different way — one that has proved more successful and given us a world lead.

Robots as computer peripherals can add a further dimension to computer-based education. Instead of writing a program and only seeing the results displayed on the screen it is possible now to see the physical effects by way of an arm or turtle.

Courses on robotics

Arms come in a variety of forms and complexities. As a good guide it is usually the case that you get what you pay for, but it is possible to get some quite sophisticated equipment at a relatively low price.

The Beasty Arm from Commotion costs only £39.95 for which you get three axes of movement and a hook for picking up things. At the other end of the personal robot scale about £3,200 will buy the Open University Robot made by TecQuipment.

It is being used by the Open University as the basis for two courses in robotics and had to meet an exacting specification. It has six axes, a gripper, can lift 1kg and is said to be accurate to 3mm. In between there are a growing number and variety of arms.

Although the uses to which arms can be put are the same, there are different ways in which the same effect can be achieved. The more axes an arm has the more complicated movements it can perform.

The Beasty Arm can only rotate its base and move the two sections of the arm up and down. The TecQuipment MA2000 can also do that as well as having a wrist on the gripper which can rotate, pitch and yaw.

Five axes are more usual, however, with the wrist only having the ability to rotate and move up and down — examples are the Armdroid from Colne Robotics, the Genesis series from Powertran Cybernetics and the Atlas from LJ Electronics.

There are almost 20 arms on the market in Britain, the majority of which are British

"Do the washing up, hit the kids, strangle the cat" — that's the sort of robot promised by most of the automaton manufacturers riding on the back of the micro boom according to Jon Barron of McAndroids.

When he isn't making parts for old Harley Davidsons or inventing special effects for film and TV like a ten foot treadmill for a Bronski Beat video, Jon builds androids like the one on the left. Together with sculptors Alan Dun and Richard Glassborow and an electronics engineer, Jon's been in the McAndroids business for a year.

The first McAndroid is 5ft 7in tall because "a very big figure is threatening" and the McAs are trying to make robots friendly. The androids are built out of glass fibre and chromed epoxy resin joints, powered by model aircraft servo motors connected to a new patented valve design, and controlled by a Zilog controller board.

The McAndroids are way beyond the price bracket of even expensive robots like the Heros but the ideas that the team are working on now could be used for cheap units which would plug into a home computer. At times Alan is amazed at how slow the outside world has been in catching up with developments in robotics — Yellow Pages still refuses to open up a category for robots "it took them seven years to get round to videos".

developments.

Movement is usually provided by stepper motors or servos and can be controlled by a variety of micros with the BBC B being the most popular.

The area in which they tend to differ is in the drive mechanisms. Most use a transmission system to take the power from the motor to the joint with varying degrees of sophistication. The Armdroid, costing about £500, uses non-stretch nylon cords, the Atlas, at £1,950, has a toothed belt and the latest machine from Cybernetics Applications, Neptune, £1,250, uses hydraulics Pneumatic systems are being assessed by other companies.

Accuracy and cost are the two factors to be taken into account when deciding on the transmission system. Hydraulic and pneumatic systems are usually more accurate than cord or belt systems but they are also more expensive. LJ Electronics however has achieved a high degree of accuracy with the belts on its Atlas.

All the manufacturers see education as their major market with small, light industrial uses coming second and home sales a poor third. This is probably due to the lack of software. What is available is usually concerned with putting the arms through their paces and simulating the larger arms to be found on the production lines.

Cyber Robotics has launched a package which illustrates that. Most of the programs for the Cyber 310 simulated other types of arm, although it did contain a program which solved the Towers of Hanoi puzzle.

It is a market which is profitable for many small companies and there is a growing number of them seeking to enter.

Whereas arms are mainly used as smaller versions of industrial equipment, turtles were developed to expand children's ability to learn. They are based on the theories of Seymour Papert, who wrote Logo as a high level educational language. One of its capabilities was to allow children, using simple commands, to control a character on the screen known as a turtle.

From that were developed peripherals called turtles which were mobile devices with a pen attached which could draw designs under the control of the compouter. They were similar to plotters but with far greater freedom of movement.

(continued on page 55)



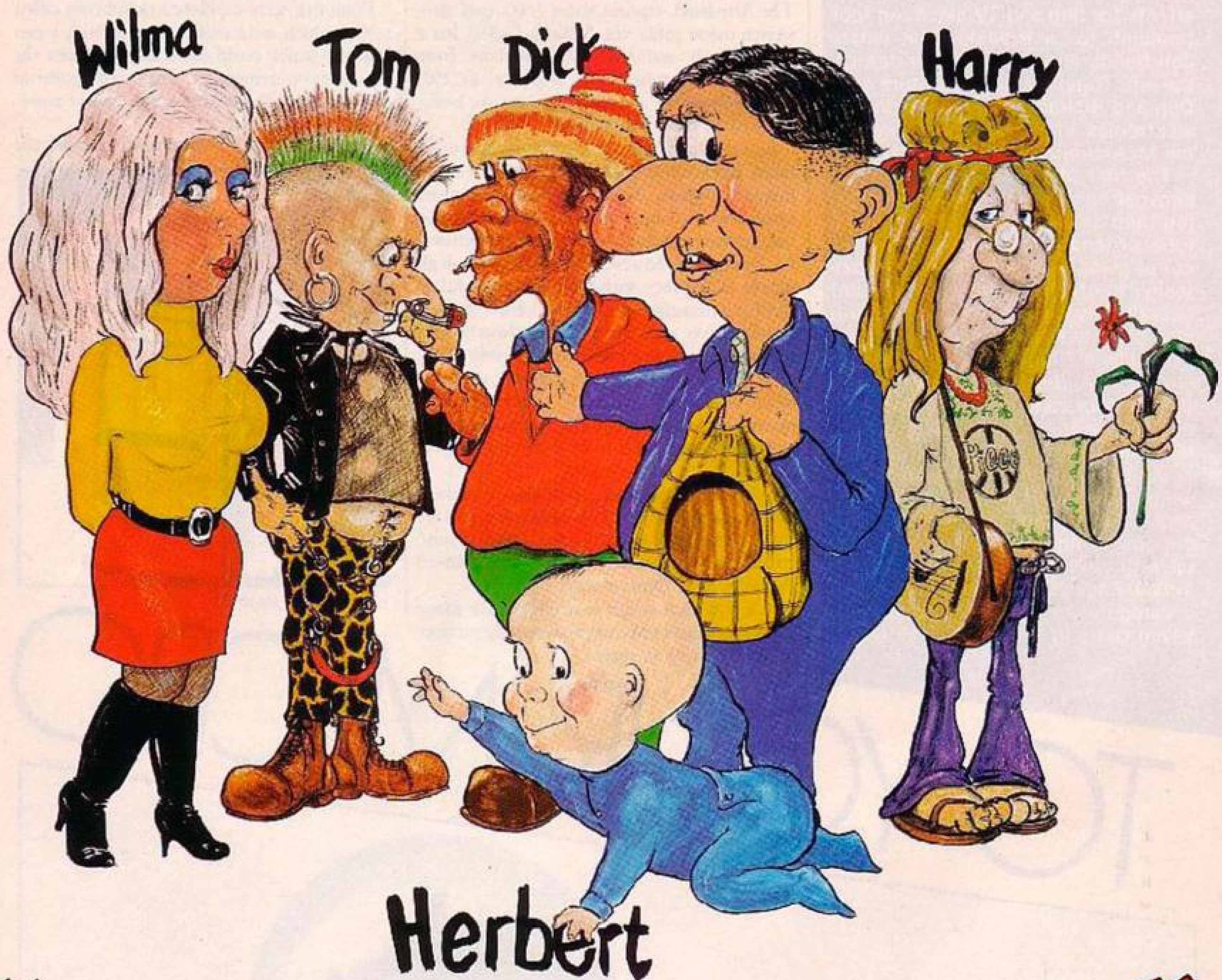
Hero — see page 51.

E TO YOUR MICRO



Tomy's twins.

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(continued from page 53)

There are four British turtles on the market with the addition of the Penman plotter which is designed similar to a turtle and can be used as one.

The most traditional is the Jessop or Edinburgh turtle. Looking like an upturned mixing bowl with two drive wheels and a pen holder inside it closely resembles the original design. It can be controlled from most of the popular micros via an umbilical cord.

Hebot II from Powertran is a similar design but only available in kit. The most famous at the moment is probably the BBC Buggy due to its appearances on television in the series *Making the Most of the Micro*. Like Hebot it is less to do with the encouraging of different forms of education then with teaching people about computer control and robotic sensing.

Valiant Designs has gone for the same Papert route as the Jessop and the company's Valiant can be controlled by the various dialects of Logo which are available for the usual micros. It is the only one which has been designed to look like a turtle although it has the same basic two-wheel drive and retractable pen holder of the others.

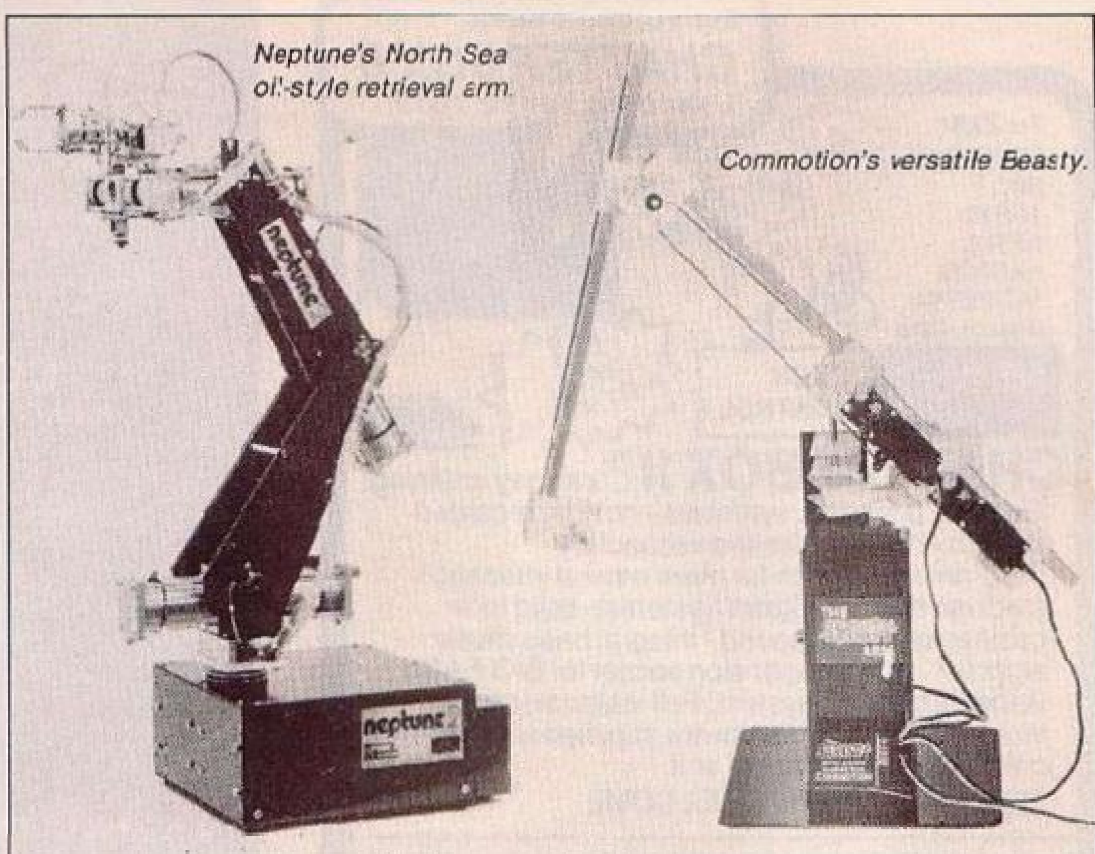
Little applications software

It is expected that these will be joined by other versions later this year. The Zeaker, which worked with a ZX-81 and was sold by Colne Robotics, is being redesigned by IGR and should be on sale soon. From the United States there is news that Androbot has finally got Fred into production and looking at the possibility of sending some to Britain.

In common with the arms there is little applications software available for the turtles. One of the exciting prospects for 1985 is the launch of Trekker and a suite of 30 programs. It has been developed by a secondary school in North Wales and is being produced in conjunction with the ITV program, *The Micro at Work*. The software covers a whole range of applications in maths and robotics.

One area that has not as yet concerned British manufacturers is toys. That has been left to the Japanese and Americans. They have not produced anything which is very complicated but they are cheap and have some approximation to robots.

One of the first was the Big Trak from Milton Bradley. It is a large tank-like vehicle which has a keypad on its top which is used to give directions and costs £30. A similar product



Neptune's North Sea oil-style retrieval arm.

Commotion's versatile Beasty.

was launched last year. It is called George the Compurobot and costs just under £25.

Tomy Toys aimed for the Christmas market with the launch of three new robots in November. They have been producing a toy arm, the Armatron for some time and now have the Dingbot at £5.99, the Verbot at £39.95 and the Omnibot at £149.95.

The success of last year though was probably the Movits. Imported from Japan they ranged in price from £9.99 to £34.99. The most expensive was a simple turtle which could be programmed using a small controller. There are now interfaces available which allow it to be connected to a Spectrum. A further robot, the Wizard, has recently been added to the range.

There is undoubtedly a great deal of interest in robots. They can be guaranteed to attract a crowd wherever they go and a number of companies use them in promotional work. They are only radio-controlled models but they fit people's views of what robots should look like, views which have been conditioned by fiction such as *Star Wars* or the *Hitchhikers Guide to the Galaxy*.

Those views are being further developed by people such as Jim Whiting whose wonderful mobile sculptures, controlled by a Spectrum, never fail to astonish large numbers of people.

Reality is more mundane. The arms, turtles and toys represent the limits of what can be achieved in personal robots at the moment. While they perform a useful function, particularly in education, they fall far short of the expectations of the general public.

There are problems in meeting these expectations which are concerned with information gathering and processing. Walking across a room avoiding obstacles such as tables and chairs is beyond the capabilities of any robot which could be produced at a cost which would make it attractive for use in the home.

The robot needs to have senses such as touch or sight to locate the obstacles and then intelligence to react in such a way that it makes progress across the room. A fairly simple device could avoid the obstacles but would react like a pinball machine without any guarantee that it would reach its goal.

The Robat competition

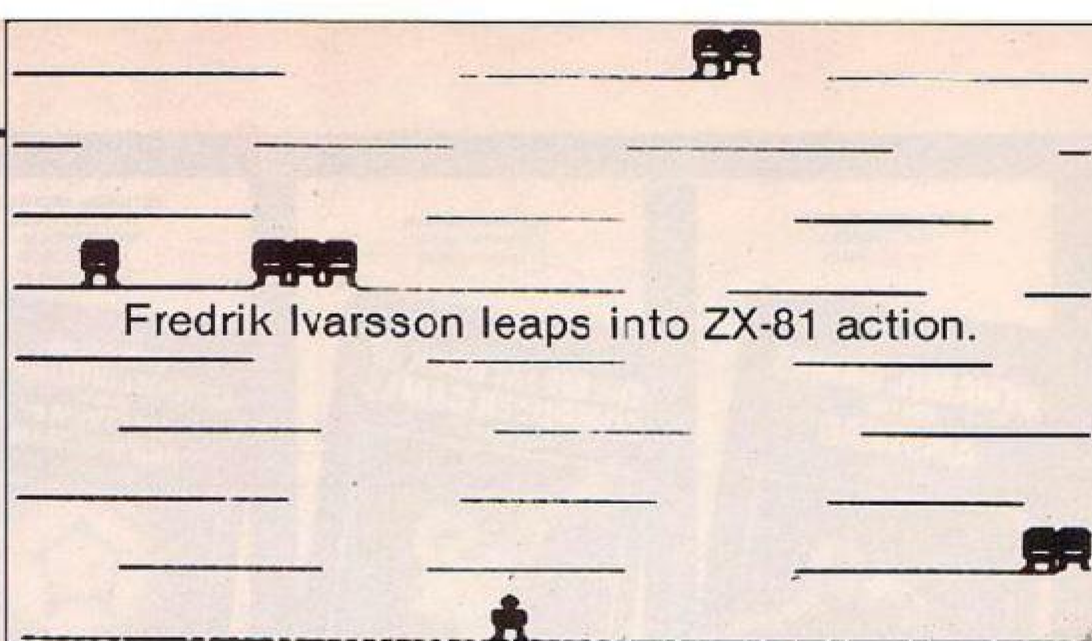
To help it decide which way to move it would need to store in memory the overall direction in which it should be going and detailed description of all the obstacles it may meet on the way. For example, if it came across the settee it would need to know where it had hit the settee by comparing the information it could gather with that in its memory so it would know to alter course to ensure getting round the settee in the simplest way. Anything more complex and a huge memory would be needed with some form of artificial intelligence to sort through it.

There is no lack of enthusiasm for tackling these difficulties. John Billingsley of Portsmouth Polytechnic, who began the micromouse contests, has now launched a new problem — the Robat competition. The aim is to create a machine which can play a form of robot table tennis.

There has been a huge amount of interest throughout the world and prototypes are already taking shape. Solutions found in this contest might provide the basis for more commercial applications later. ■



Penman crosses robot and plotter.



MAD JUMP

A FRIEND OF MINE had an Oric program in the September issue of *Your Computer*. I have invented a similar game for the ZX-81 16K. You move Matt on platforms and try to jump up to the top of the screen but watch out for the monsters. If you are on the second platform and fall down to the first platform you will die. You score 10 points every time you jump and, if you reach the top, 500 points in bonus.

Now, to enter the program, first set Ramtop to 26368 by typing:

```
POKE 16389,103                N/L
NEW                           N/L
```

Now make a 946 bytes long Rem statement by making line 1 to 10 89 characters. Then Poke as direct commands:

```
POKE 16514,118
POKE 16515,118
POKE 16511,178
POKE 16512,3
POKE 16510,0
```

You will now have an empty Rem statement. Now enter the hexloader in listing 1. If you don't want to see line 0 every time you enter a line you can type:

```
LIST 1
POKE 16419,1
```

Run the hexloader and type in all the machine code in listing 2. When that is ready, delete the hexloader and enter the Basic program in listing 3. When you have done that save the program by typing: GOTO 450 ■

Listing 1.

```
  5 REM HEXLOADER
 10 PRINT "START ADDRESS"
 20 INPUT S
 30 PRINT "FINISH ADDRESS"
 40 INPUT F
 50 FOR N=S TO F STEP 8
 60 LET T=0
 70 PRINT N;": ";
 80 INPUT A$
 90 PRINT A$;" = ";
100 INPUT TOT
110 PRINT TOT
115 IF PEEK 16422=2 THEN SCROLL
120 LET Z=0
130 FOR K=1 TO LEN A$ STEP 2
140 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
150 LET T=T+C
160 POKE N+Z,C
170 LET Z=Z+1
180 NEXT K
190 IF TOT=T THEN GOTO 220
200 PRINT "ERROR - PLEASE INPUT
AGAIN"
205 IF PEEK 16442=2 THEN SCROLL
210 GOTO 60
220 NEXT N
```

Listing 2.

```
  2 LET HI=100
  3 LET A$="ZX81"
  4 CLS
  5 LET L=5
 10 PRINT TAB 10,"MADJUMP II"
 20 PRINT AT 21,0;"MADE BY FRED
RIK IVARSSON"
 25 GOSUB 300
 30 PRINT AT 2,0,"Z TO V : MOVE
 LEFT"
 40 PRINT "5 TO £ : MOVE RIGHT"
 50 PRINT "A TO NL: JUMP"
 60 PRINT
 70 PRINT "PRESS ANY KEY TO STA
RT THE GAME"
 80 IF INKEY$="" THEN GOTO 80
 85 CLS
 90 RAND USR 17383
100 PRINT TAB 10,"MADJUMP II"
102 PRINT AT 21,0;"MADE BY FRED
RIK IVARSSON"
103 PRINT AT 1,0;
110 PRINT
115 IF L=1 THEN GOTO 210
120 PRINT "LIVES ";L-1
125 PRINT
130 PRINT "SCORE:",PEEK 16528+2
56*PEEK 16529
140 PRINT
160 LET L=L-1
170 PRINT "PRESS A KEY TO CONTI
NUE THE GAME"
180 IF INKEY$="" THEN GOTO 180
185 CLS
190 RAND USR 17390
200 GOTO 100
210 PRINT "ALL LIVES LOST"
220 PRINT
230 PRINT "YOU SCORED:",PEEK 16
528+256*PEEK 16529
240 PRINT
250 GOSUB 370
251 PRINT A$;" HAVE THE HI-SCOR
E:";HI
252 PRINT
255 PRINT "DO YOU WANT TO PLAY
AGAIN ?"
260 IF INKEY$="" THEN GOTO 260
270 IF INKEY$="Y" THEN GOTO 4
280 IF INKEY$<>"N" THEN GOTO 26
0
290 CLS
295 STOP
320 PRINT AT 2,0;"INPUT SPEED 1
(FAST)-100(SLOW)"
330 INPUT S
340 IF S<1 OR S>100 THEN GOTO 3
30
350 POKE 17307,S
352 POKE 17254,200-S
354 POKE 17165,200/S
355 PRINT AT 2,0;"
                  ";AT 2,0;
360 RETURN
370 IF PEEK 16528+256*PEEK 1652
9<=HI THEN RETURN
380 PRINT "GOOD,A NEW HI-SCORE"
390 LET HI=PEEK 16528+256*PEEK
16529
395 PRINT
400 PRINT "WHAT IS YOUR NAME?"
410 INPUT A$
420 IF LEN A$>10 THEN GOTO 410
430 PRINT AT 8,0;
440 RETURN
450 SAVE "MADJUMP T"
460 RUN
```

Listing 3.

```
16514: 7E76000202040101 = 246
16522: 0E0401C77A4A1400 = 426
16530: 3E01328F40210000 = 353
16538: 229040CD6E43CD04 = 901
16546: 43210B7D06203694 = 476
16554: 2310FB0520C5CDAD = 915
16562: 41C10520F8218D7B = 840
16570: 228D40CDAB42FE0A = 940
16578: C8CDAD41C3D143CD = 1319
16586: FE432A8D40118C01 = 725
16594: 197EFE142A8D4020 = 704
16602: 0CFE1FC30000C30C = 020
16610: 41CD8843000002A = 563
16618: 8D403A2540FEBF28 = 849
16626: 0FFE7F285AFEFE28 = 1069
16634: 6918C1CDF84211C5 = 1055
16642: 0037ED52CDAB42E5 = 1045
16650: CDAD41CD2142E1CD = 1177
16658: CF4311200037ED52 = 692
16666: 7EFE14C000001188 = 748
16674: 0137CDF543FE6720 = 962
16682: 17E52A904011F401 = 764
16690: 1922904 0E13A6643 = 719
16698: 3D3DCDC343C39C40 = 1005
16706: E52A9040110A0019 = 531
16714: 229040E1C3BD40CD = 1120
16722: F8422 37EFEC92007 = 969
16730: 111F0037ED5200C3 = 617
16738: BD40CDF84228 7EFE = 1195
16746: C92005 1120001900 = 312
16754: C3BD403A3440E61F = 883
16762: 4710FE0000000000 = 341
16770: 210B7D5FAF571936 = 605
16778: 17C9CDE04311AD01 = 911
16786: 19E5CDAB42CD2244 = 1003
16794: C31644E1CDCA4311 = 1001
16802: C600197EFE1FC8C3 = 1029
16810: 054400AF328C4021 = 535
16818: 7469118440061F7E = 597
16826: 2877232310F9281F = 566
16834: FE002804 3D121824 = 437
16842: 7EFE1428073E0232 = 561
16850: E1411000 3E0532E1 = 661
16858: 413A3440E602C602 = 671
16866: 127EFE1428043614 = 536
16874: 180236940172023F = 403
16882: 0040FC0120030174 = 611
16890: 0209137BFE8CC83F = 805
16898: 8C401F3F17328C40 = 575
16906: FE00CA8741061F7E = 867
16914: 23772B2B10F923C3 = 735
16922: C141000000000AF = 433
16930: 328C40210C790620 = 456
16938: 7EFE0A28052310F8 = 734
16946: 1828CDF842287E23 = 787
16954: FEC9280C00000000 = 507
16962: 0028CDD7422318E0 = 812
16970: 1173027DFE0C28DD = 786
16978: 19CDD742183 7ED52 = 912
16986: 18D37CFE67C83A8C = 1114
16994: 401F3F17328C4011 = 452
17002: 7302FE0020031171 = 536
17010: 0237ED52FE0028AE = 844
17018: 06207EFE0A28052E = 516
17026: 10F818D6CDF84223 = 1056
17034: 7EFEC9280B000000 = 632
17042: 0000CDD7422818E2 = 779
17050: 11720219CDD74211 = 661
17058: 710237ED5218D800 = 729
17066: 00119A437EF5060E = 626
17074: 1A7713C501210009 = 404
17082: C110F5F1016A01FE = 1057
17090: 0A28017E360537ED = 528
17098: 42228D40C9000000 = 506
17106: 0000000000D5C57E = 536
17114: 00000000011A643 = 250
17122: 060C1A7713C50121 = 413
17130: 0009C110F5018B01 = 604
17138: 37ED423D1D1C9C511 = 1175
17146: 2100060C36141910 = 166
17154: FB118B0137ED52C1 = 975
17162: C900063878ED47C5 = 1032
17170: CDB843C110F60000 = 911
17178: 000000000000CD8F = 348
17186: 43C9000021DFE611 = 771
17194: 2100F30EFE060610 = 572
17202: FE060C0ED78D3FF19 = 1300
17210: CD4E4305C23543CD = 874
17218: 9202CD2002DD2128 = 679
17226: 43C3A402E9C90000 = 862
17234: 3A8F403D328F40FE = 837
17242: FFC021E767CDD742 = 1300
17250: 3A34405E6C7328F40 = 860
17258: C900000021006 70E = 351
17266: C0062036 142310FE = 606
17274: 36C9230D20F3C900 = 779
17282: 00003E00ED47DD21 = 624
17290: 2643C900003E1EED = 635
17298: 47DD213102C90000 = 657
17306: 1511111594 9E9E9E = 698
17314: 0A1E1E000A949E9E = 544
17322: 95941F940A1E1E05 = 551
17330: E1D1C30C433D0601 = 776
17338: C506FF10FEC110F8 = 1185
17346: C9CDB843326643C9 = 1077
17354: CDB843CDF842C9CD = 1381
17362: 21422A3D407EFE0F = 736
17370: C800003C940CDB8 = 1049
17378: 43CDF8420 9CD9240 = 1202
17386: CD0C43C9CD9D40C3 = 1106
17394: 0C4300ED527CFE68 = 880
17402: C03E67C9CD5243CD = 1117
17410: 7541C9CDAB42118C = 982
17418: 01197F2AAD40FE17 = 676
17426: C8C3BD40E511E700 = 1125
17434: 7EFE0AE1C8C39D41 = 1232
17442: CD2142CDAD41C982 = 1078
```

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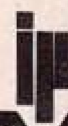
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TERRAPIN IS A machine-code game for any Spectrum. It features high resolution movement, colour graphics, sound effects and a high score table. First, to set up the program, type in the first machine-code listing. The data is carefully checksummed so that virtually any error will be detected. If a length error occurs when you Run the program, check the left- and right-hand columns of the line concerned.

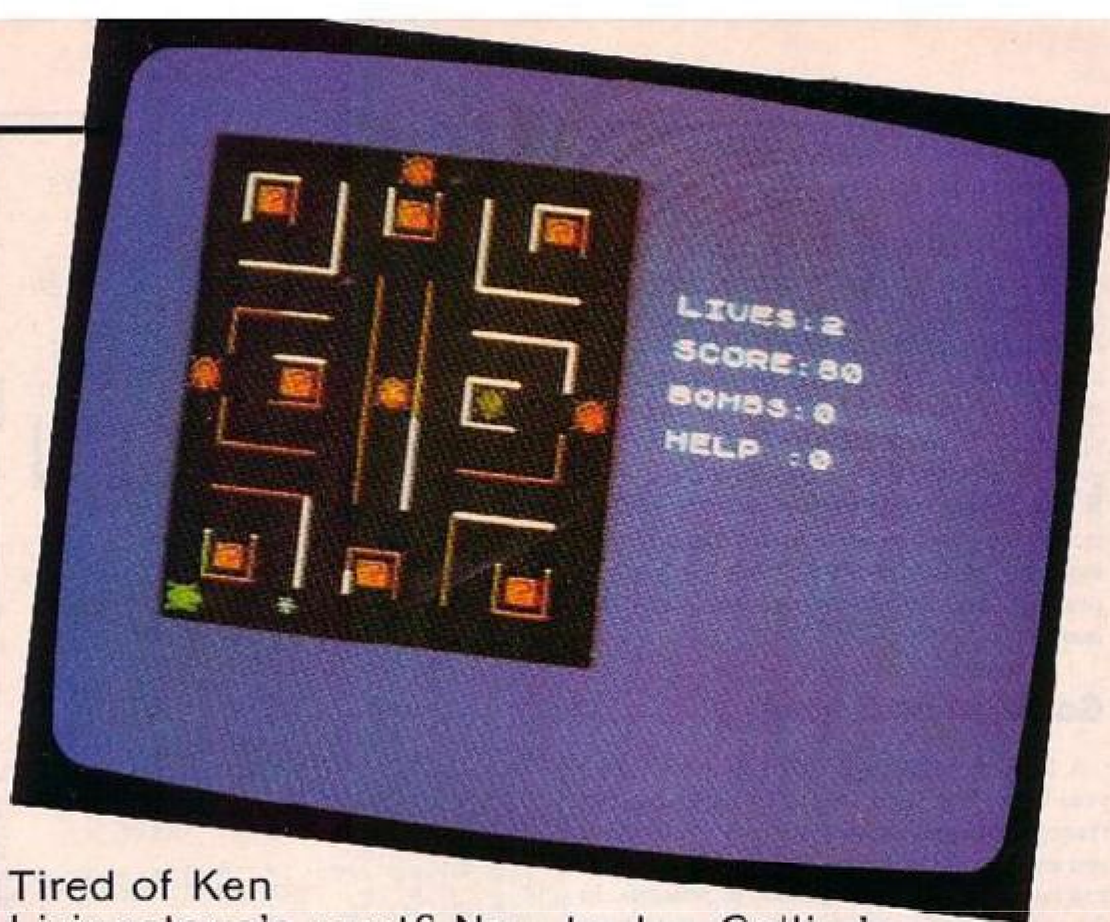
The error will be between the last correct number — or letter — and the first wrong one. In the case of a checksum error the position is more vague but, generally, the larger the difference the further along the line it is. There is always the possibility that you have typed in the checksum wrongly — this is in the first six digits. When this new program runs without errors, save it — just in case — and type New. The program will disappear but not the code.

Run completed version

Enter the second program and Run it in the same way, then save it. Type New again and enter the shorter Basic listing. The whole program can now be saved by Run 9000. It will almost certainly be error-free because of the checksum.

You can now Run the completed version. If you switched off at any time between typing, Load and Run the machine-code listings

(continued on next page)



Tired of Ken Livingstone's newt? Now try Ian Collier's . . .

TERRAPIN

Program 1.

```
 10 DATA "241924021d1ddd7e09942
80330021515d5160001000007ba7c4527
7d178b1c01e007aa7c4527778b1c0cdc
577573e0acd167a3cdd77107a110101f
5af9257feff200511ff"
 20 DATA "297623001800efe00200aa
f935ffe0128031100fff1cd937730dff
5dd7e103d281cf578ed44ba200679ed4
4bb2808f13d3dfefa3008f5f1dd7710f
110bcf1d5c1c36477c5"
 30 DATA "22328547e52601ed5f6f7
ee1fd863eb838039018fac1c9e5d5c5f
5ed4b425b0600211a05cd5d7a2424ed4
b405bcd5d7a3e30d72424ed4b445b060
0cd5d7a3e06d72424ed"
 40 DATA "1151844b455b0600e55e1
6d77cd77dd7cd2b2dcde32de17cfe0bc
0f1c1d1e1c9005f0001405f0001805f0
00140af0100400f0100ff0000000000
0000000000000000000000"
 50 DATA "000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
0000000000000000000000"
 60 DATA "253293e3d5c5f5dde5e9e
1dde1f1c1d1e3c9cdda7a115000216b0
1cdb503cde17ac9cdda7a0605c5110a0
0212003cdb503110a00215802cdb503c
110eacde17ac9cdda7a"
 70 DATA "24583221e803060ac5e51
10500cdb503e1c1113200ed5210efcde
17ac9cdda7a061421f401c5e5110500c
db503e1c11128001910f0cde17ac9cdd
a7a0605218403c5e511"
 80 DATA "1345360300cdb503e1c11
13200ed5210efcde17ac9cdda7a060a2
1e803c5e5110200cdb50310fee1c110f
2cde17ac900000000000000000000000
0000000000000000000000"
 90 DATA "26132800000000021e37
b7efeffc8fe00282a1101014e2346237
9fd96433004ed441d1d4f78fd9644300
4ed44151547d9e5d9e5cdba24e1d9e1d
918ce234e234623e5cd"
 100 DATA "177220e522e118c2000f9
00fa01fa01f90002fa02f800f80003fa
03f904f904fa0005fa05f807f80006f9
06fa07fa07f90000f600f702f70001f6
02f602f501f50003f80"
 110 DATA "0994823f30004f804f300
05f707f707f60006f605f605f506f500
00f500f402f40005f407f407f50000f3
02f302f10000f200f101f101f20003f1
03f204f204f10005f10"
 120 DATA "16E2345f307f30006f206
f107f107f20ffcd6b0d3e02cd0116cda
27b06083e0221c07c1602c54e234623c
db67dc110f50e43065c16063e80cd007
d3a485c061621125811"
 130 DATA "14682112000e0e77230c2
0fb1910f61f1f1ff608d3fee60732d27
caf11d07cc30a0c109f409f709f205f6
05f101f401f701f801101100916050144
c495645533a33160714"
 140 DATA "26381653434f52453a301
60914424f4d42555a5316000b14484d4c5
0203a30a00000c5e5d5f5cdaa22dd210
45bdd77012206265bf1d1cda77dd5f5ed5
b365cfe803806d680ed"
 150 DATA "2490865b7b5c6f2600292
92919dd360008dd460122085be5d12a0
65b78fe00282b1a0effcb3fcb3910faa
ea1ae7723dd7e012fc609470eff1acb2
7cb2110faaea1ae77f1"
 160 DATA "236609d1cda77dd5f5180
21a772a065b7ce607fe0720177dfee03
8051120ff18031120f81924f1c1cda77
dd5f5252422065b2a085b23dd7e003dd
d7700fe00208ff1d1e1"
 170 DATA "231624c1c9e5f57c0f0f0
fe603f6586772f1e1c9c5f5c5f5cd007
d79c6074ff13ccd007dc1f578d60747f
13cf5cd007d79c6074ff13ccd007df1c
1c90000000000000000"
 180 DATA "150660000000000000000
00000472e1c1c2a4700000000000000000
000000001f1c1b1f1f000000f818e8e
8981f1e1f1e1f0000009678f878f8000
00000003f60c080ff80"
 190 DATA "17788430 30fe320705ff0
58080b7b5858585ff0505b5b5858586f
c0000231700c1b171f0000c4e830d8e8f
81f1f1f0b17230000f8f8f8d0e8c4000
0000023170b1f1f100"
 200 DATA "15320400c4e8d0f8f8f81
f171b0c17230000f8e8d830e8c400000
00020170f173f3f000004e8b0d8ececc3
f3f170f17200000ececd3b0e80400000
00020170d1b37370000"
 210 DATA "15663204e3f0e8fcfc373
71b0d17200000fcfce8f0e8040000000
033170f1f1f1f000098d0e0f0f0f01f0
f17330703000f0e0c09dc0800000000
00103190b070f0000c0"
 220 DATA "138996e0cce8f0f80f0f0
f070b190200f8f8f8f0e8cc000000000
80d03173f3f000004ecf0f8fcfc3f170
30d08000000fcf8f0ec040000000000
020370f1f3f00000010"
 230 DATA "174862b0c0e8fc3f3f1f0
f3720000 0fcfce8c0b0100000005a3c7
e7e7e3c5a5a3c7e7e7e3c5a0000ba7cf
efe7cba00005d3e7f7f3e5d000000331
70b181b18000098d0a0"
 240 DATA "1371130b030180b17330
703000030a0d098c080000000000001031
90b050c0000c0e0cce8d0180c0d0c050
b19000018d818d0e8cc00000000000B0d0
3143e3e000004ecf008"
 250 DATA "0693015c5c3e14030d080
000005c03f0ec04000000000000020370
f103a0000010b0c0287c3a3a100f372
000007c7c28c0b01000000000000000
0000000000000000000"
 260 RESTORE : LET z=31125
 270 FOR x=10 TO 250 STEP 10: RE
AD a$: IF LEN a$<>136 THEN PRINT
 "Length error in line ";x: BEEP
 .1,30: STOP
 280 LET t=VAL a$( TO 6): LET a$
=a$(7 TO )
 290 FOR y=1 TO 65: LET a=CODE a
$: LET b=CODE a$(2)
 300 LET a=(a-48-39*(a>96))*16+b
-48-(b>96)*39: LET t=t-a*y: POKE
 z,a: LET z=z+1
 310 LET a$=a$(3 TO ): NEXT y
 320 IF t THEN PRINT "Sumcheck e
rror in line ";x'" Difference=";
t: BEEP .1,25: STOP
 330 PRINT "Line ";x;" OK": NEXT
 x
 340 SAVE "CODE 2"CODE 31125,162
5: VERIFY ""CODE
```

(continued from previous page)
before typing in and saving the completed version.

The control options will appear on the screen. The keyboard option uses keys QWER and T — left, right, up and down and bomb respectively — which is perhaps a little awkward, but was easier to program and you may be in practice already from using other programs. If you wish to use the cursor keys, press 2 and get the Cursor joystick option. When you are ready press 0 to start. The object of the game is to stay away from the red bugs and to save as many baby terrapins as possible. You do this by entering a question mark.

Go on to next level

A baby terrapin will probably climb onto your back. You must take it home by passing through the house which appears. However if you are unlucky, another bug will emerge and you have to get away as quickly as possible. In the eight question marks there are two bugs and six babies. When you have helped all six, you go on to the next level, which is the same, but a little more difficult and a different colour.

You get 100 points for entering a question mark containing a baby, 150 points for taking the baby back home, 50 points for stunning a bug and 80 points for entering a question mark containing a bug. If you get a high score you are asked to enter your name.

The levels differ in the method of controlling the bugs. They start off random and become more attracted to you as you finish each level.

The Basic program.

```
  10 BRIGHT 1: CLS
  30 POKE 23675,239: POKE 23676,
125: REM udg pointer
  35 LET lr=30460: LET kb=255: L
ET ke=63-255: LET cu=34-255
  40 DIM a$(8,20): DIM a(8)
  50 DIM b$(3,18): RESTORE : REA
D b$(1),b$(2),b$(3),b
  60 DATA "  KEYBOARD","  CURSOR J
OYSTICK","  KEMPSTON JOYSTICK",1
  70 CLS : FOR x=1 TO 3: PRINT A
T x*2+6,5;x;b$(x): NEXT x: PRINT
 AT 14,5;"0 START GAME";AT 0,0;"
TERRAPIN
"
  75 PRINT "  INK 6;"  ©    By I
.M.Collier"
  76 LET o=0
  80 PRINT FLASH 1;AT b*2+6,5;b;
b$(b)
  90 PAUSE 300: IF INKEY$="" THE
N GO TO 120
  95 LET s=0
 100 LET i$=INKEY$: IF (i$>="1"
AND i$<"4") OR i$="0" THEN LET a
=VAL i$: IF NOT a THEN GO TO 200
 110 IF a THEN PRINT AT b*2+6,5;
b;b$(b): LET b=a: GO TO 80-o
 120 CLS : PRINT "        TERRAPI
N HIGH SCORES"'': FOR x=1 TO 8:
 PRINT a$(x);"  ";a(x): NEXT x
 125 LET o=10
 130 PAUSE 200: IF INKEY$>="0" A
ND INKEY$<"4" THEN GO TO 95
 140 GO TO 70
 200 POKE kr+2,118+(b>1): POKE (
r+1,kb+(ke AND b=3)+(cu AND b=2)
 205 RANDOMIZE USR 29500: PAUSE
1: BEEP .2,-15: BEEP .2,-22: PAU
SE 1: PAUSE 150
 210 LET s=(PEEK 23360+256*PEEK
23361)*10: BORDER 0
 215 LET y=1
 220 IF s<=a(y) THEN LET y=y+1:
GO TO 70+150*(y<9)
 230 CLS : PRINT "  CONGRATULATI
ONS! YOU HAVE THE      ";(STR$
y) AND y=1;"ND" AND y=2;"RD" AN
D y=3;"TH" AND y>3;" HIGHEST SCO
RE"''"      ENTER YOUR NAME": L
ET n$=""
 240 PRINT AT 5,6;"<_____________
______>"
 245 PRINT AT 5,7;n$;"_" AND LEN
n$<20
 250 PAUSE 0: BEEP .01,34: LET i
$=INKEY$: IF i$=CHR$ 12 AND LEN
n$ THEN LET n$=n$( TO LEN n$-1)
 255 IF (i$<"@" OR i$>"~") AND i
$<>CHR$ 13 THEN GO TO 245
 260 IF i$<>CHR$ 13 AND LEN n$<2
0 THEN LET n$=n$+i$: GO TO 245
 265 IF i$<>CHR$ 13 THEN GO TO 2
45
 270 FOR x=7 TO y STEP -1: LET a
(x+1)=a(x): LET a$(x+1)=a$(x)
 280 NEXT x: LET a(y)=s: LET a$(
y)=n$
 290 GO TO 70
1000 BORDER 0: PAPER 0: INK 7: C
LEAR 29499: LOAD ""CODE : RUN
9000 REM RUN 9000 TO SAVE
9010 SAVE "TERRAPIN" LINE 1000:
SAVE "CODE "CODE 29500,3268: VER
IFY "": VERIFY ""CODE : CLS : PR
INT "Verified OK": STOP
```

Program 2

```
  10 DATA "179136dd21045b2100002
2405bdd360c00dd363f00dd363e03dd3
64003dd3641012l4c5b224a5b360ddd3
62fffdd3634ffdd3614ff21195b06080
e003e03cd167afe0020"
  20 DATA "1846830a79fe0228053600
20c1802360123l0e879fe02281606013
e08cd167a5f160021195b197efe0220d
e2318f8dd7e4137878732485cdd360f9
a2100af22115bdd360c"
  30 DATA "22329000cd6e7ccd2b7a2
1757a11225b0605c54eeda00346eda00
31afeff280c3e0012d516423e8acdb67
dd113eda0eda0c110de01000fed430c5
bcda578dd3612010632"
  40 DATA "180338fb7610fddd35122
03cdd3612052l4c5b7efe00280d4e234
623160533e2acd007d18eedd7e14feff2
00a01435c16063e80cd007ddd7e0cfe0
0280bed4b115b16073e"
  50 DATA "222917b6cdb67dcda578c
dc6783013dc3514dd7e40c603de00dd7
740cd2b7ac31475dd7e14feff2803dd3
514cd477930le2a405b110f001922405
bdd343fcdf97acd2b7a"
  60 DATA "205544dd7e3ffe06ca6c7
6c31475dd7e0cfe00c2147521c07c111
95b7efe802675lafe0028127e91c607f
e0e300a237e90c607fe0e38062b23231
318dflafe012839e5d5"
  70 DATA "1917232a405b110800192
2405b3e00d112cd6e7bcd2b7add7e2ff
eff200edd362f0ae1452b4eed43315b1
829dd36340ae1462b4eec43365b181b3
e0012cdad762a405b11"
  80 DATA "1914720a001922405bcd2
b7add360cffdd360faeccfc763824dd7
e40fe00281ddd35402a4a5bed5b0c5b1
515lc1c732372233600224a5bcde97ac
d2b7a060521225bc54e"
  90 DATA "3243472346237ecbfe235
e235623fe002825feff28653d2b2b2b7
7232323d5e602c5d1c1f5cd3279c68a4
ff14779c5d5c1d1cdb67d1844e5c5d5c
1e1cd7979cd7676e5c5"
 100 DATA "233297e1c1cdd978335fc
deb78f5e5c5e1c1cd3279c5e5c1e1164
2c68acdb67debf1e12b722b732b30053
67fcd187bcbbe2b702b712323232323c
11083dd7e12fe012022"
 110 DATA "21654521c07c11195b7ef
e802617lafe00280d4e23462bd516423
e82cdb67dd12323l318e4c30374cd357
be1dd353ecd2b7a3ebe1607ed4b115bc
db67d21225b0605c54e"
 120 DATA "2538342346237efeff280
b3ebecdb67d232323c110eb060ac578e
60187c60257ed4b0c5b3e9acdb67d0e0
a10fe0d20fbc110e5ed4b0c5b16073eb
ecdb67ddd7e0cfeff20"
 130 DATA "2285750c21195b7efe002
320fa2b3601dd7e3efe00dd360f9acd3
60c00c2c273ed7b3d5cc3761bdd3441d
d363f00c35a73e5c5d5eb21225b06052
3237e2bfe8030127e92"
 140 DATA "268792c607fe0e300a2b7
e2393c607fe0e380a2323232310e0d1c
1e1c9d1c1e1af9047af914fc9cd517b5
52b5eed4b0e5baf9047af914ffeff200
105cd3279cb3fcb3fc6"
 150 DATA "251966aac5d5c1f53ebe1
607cd567d160478d6044779c6044ff1d
d361008ld20fd1520fa1606cd007de1e
509e5c1dd351020ebe1c9c3ff7601fef
bed7811000acb472001"
 160 DATA "2455051dcb4f2001lccb5
7200114cb5f200115cb6737200l3fc90
lfef7ed782e00cb572802cbc501feefe
d7e1f3002cbe5ade60ead18c5db1f2f0
74f0f0f4707a9e6f5a9"
 170 DATA "215378a8e6faa818b27ab
3c8cdc5772816788220067983200 2d5c
1c5f5793c2001050909f1c1c9f57afe0
028107bfe00280b78fe002804160018A0
21e00f1cd9377d5c138"
 180 DATA "313581c601000018d1f57
bfe01200af1cb4f2003f5180237c9fef
f2006f1cb5f20f5f57afe012006f1cb4
720eaf5feff2006f1cb5720e0f5f1b7c
9c5d5e57ce607fe0720"
 190 DATA "1946641d7de6072018eb2
1f0777efefe300fbb2320047eba28042
32318ef237ebfe1d1c1c900af0620af0
e30af0e40af0e409f0150af0e50af0e8
0af0c109f04709f0400"
 200 DATA "1341448f07108f0h20Af0
9308f07408f0e508f0d608f0370Ef0b8
08f0d007f07307f0d507f07807f0d306
f0d506f07005f07105f0f205f0E106f0
6706f0c605f02705f0f"
 210 DATA "08421480 5f0d104f03304
f0d504f07704f09003f07303f0d503f0
7803f0d002f07102f0e202f0c302f074
02f0b502f0d602f06702f0e802f0d101
f01401f04701f01000f"
 220 DATA "25226103200f0b300f0b4
00f0b500f0b600f0b800f09ffcdfc762
a0c5bed4b0e5bcd5277ed430e5b220c5
be51604cd3279dd860fc1c3b67ddd7e1
4feff3fc079fe40373f"
 230 DATA "235940c078d65cfe06c9d
d7e0891c607fe0ed0dd7e0990c607fe0
ec9e5214c5b7ea7283c2391fe087e233
0f490c607fe0a30edc5d5eb2a4a5bb7e
d52e5c1d5e11b1b78b1"
 240 DATA "2571552802edb0eb36002
24a5b2a405b0105000922405bcd2b7a3
7d1c1e1c9e1b7c978b120033e04c978f
e0028033c87c9793c37c608c9dd7e0cf
e00c8dd7e0d91fe02d0"
 250 DATA "223668dd7e0e90fe02d0d
d360f9add360c003ebfdd960edd770ef
eaf37c03e60dd960ddd770d37c9cdc57
7c26477dd7e41c602cd167afe023830d
d7e08110101952E0330"
 260:
 270 CLEAR 29499: RESTORE : LET
z=29500
 280 FOR x=10 TO 250 STEP 10
 290 READ a$: IF LEN a$<>136 THE
N PRINT "Length error in line ";
x: BEEP .1,30: STOP
 300 LET t=VAL a$( TO 6): LET a$
=a$(7 TO )
 310 FOR y=1 TO 65: LET a=CODE a
$: LET b=CODE a$(2): LET a=(a-48
-39*(a>96))*16+b-48-39*(b>96)
 320 LET t=t-a*y: POKE z,a: LET
z=z+1
 330 LET a$=a$(3 TO ): NEXT y
 340 IF t THEN PRINT "Sumcheck e
rror in line ";x'" Difference=";
t: BEEP .1,25: STOP
 350 PRINT "Line ";x;" OK": NEXT
 x
 360 SAVE "CODE 1"CODE 29500,162
5: VERIFY ""CODE
```

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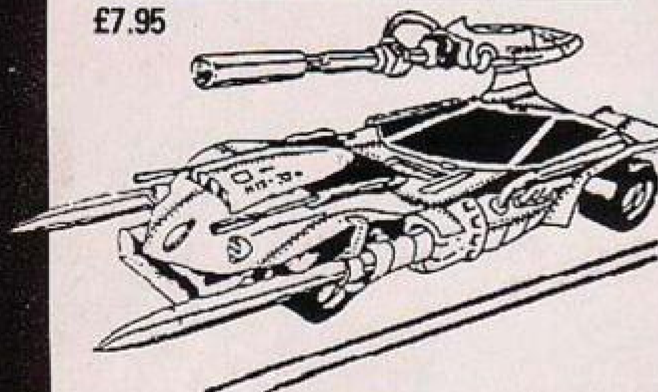


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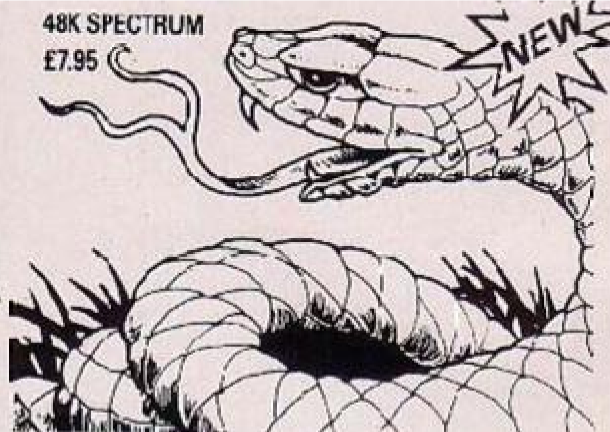




CHAOS

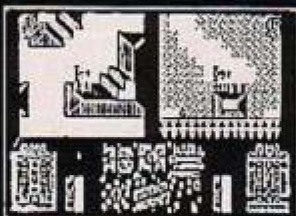
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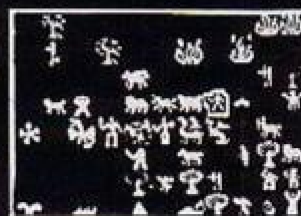
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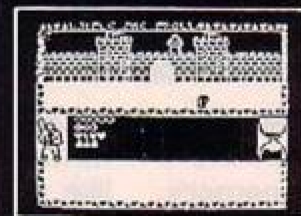
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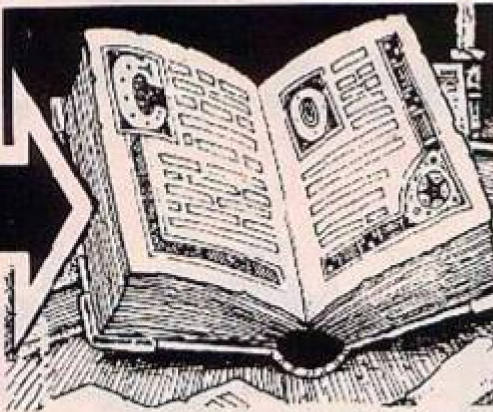






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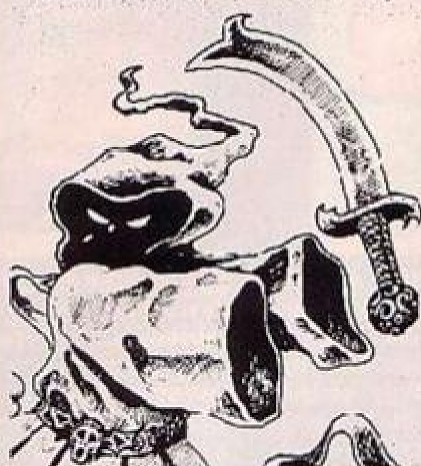




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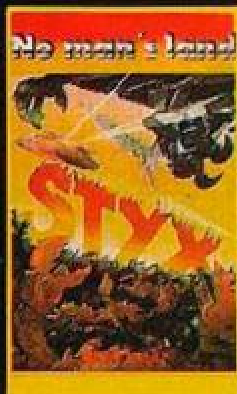
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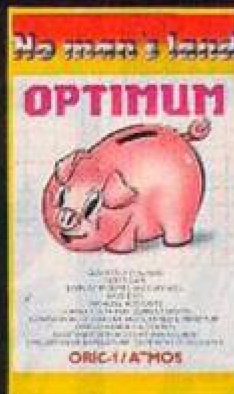
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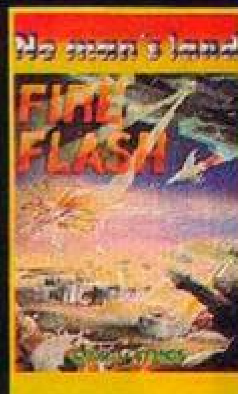
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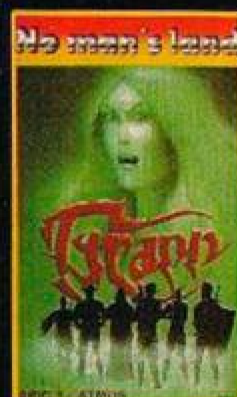
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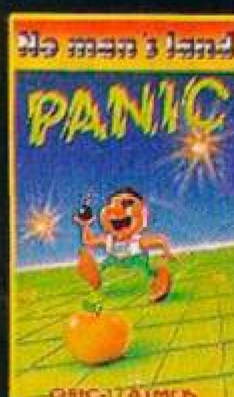
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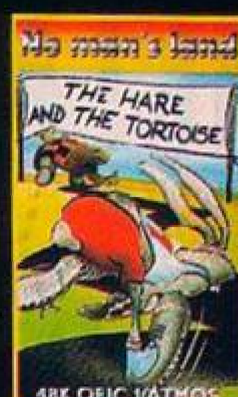
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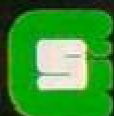
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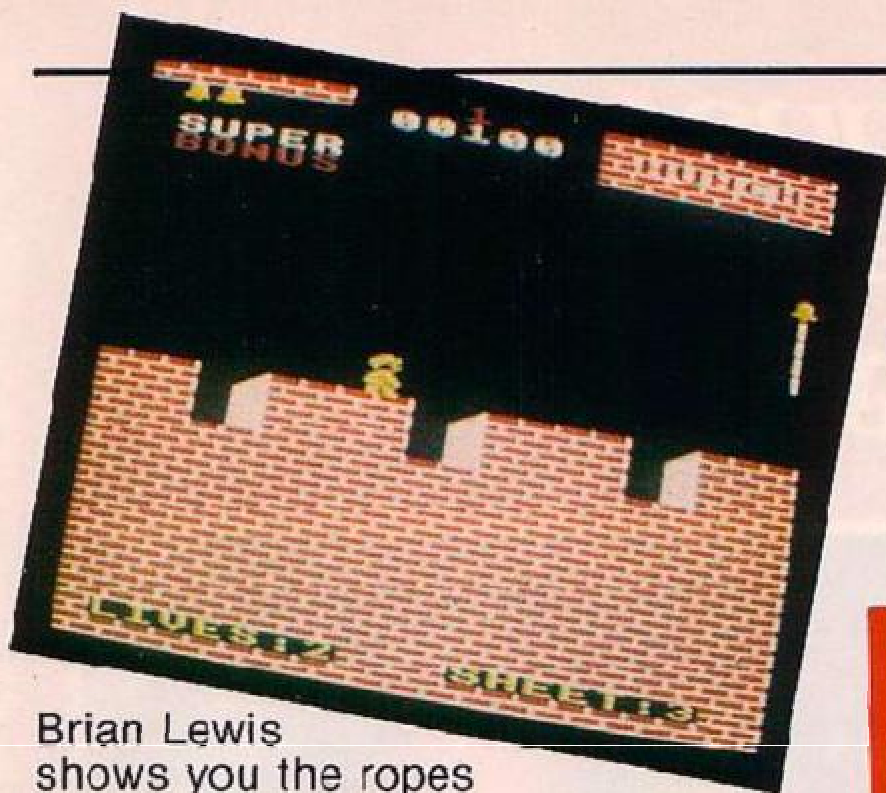
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THE BELLS

Brian Lewis shows you the ropes in a humdinger of a game.

YOU PLAY the part of the famous Quasimodo whose only true love Esmeralda has been imprisoned by evil French soldiers. You must rush to save her by first clearing 14 screens to reach her. To clear a screen you just first reach the far right-hand edge of the screen then you must jump up to reach the bell rope.

Lose one of seven lives

If you are hit by an arrow, a spear or you fall down a hole or pit you will lose one of your seven lives and start once more at the left-hand side of the screen. There is also a super bonus where if you gain four bells by clearing four screens without losing a life you will be given a 100 points bonus and if you manage to reach Esmeralda then you will be given 400 points and are sent back to the start of the course but this time the game will be faster.

My main problem was the small amount of memory I had to work with which made it hard to cram in the 15 screens and forced me to find a way to condense the screens. So I based all the screens on a brick wall and then devised a system where each time a screen was displayed a brick wall was drawn. Then any extras — like turrets and pits — were cut out of the wall.

These extras are also stored in a condensed fashion which uses a form of binary, but instead of representing numbers, the 0s and 1s represent arrows, soldiers, turrets, etc., and these binary numbers are stored in line 40 of listing 2. The number 0000 represents a bell screen as this screen was a very late addition to the program and so the binary number was too small to cover all the variables.

Written in Mode 5

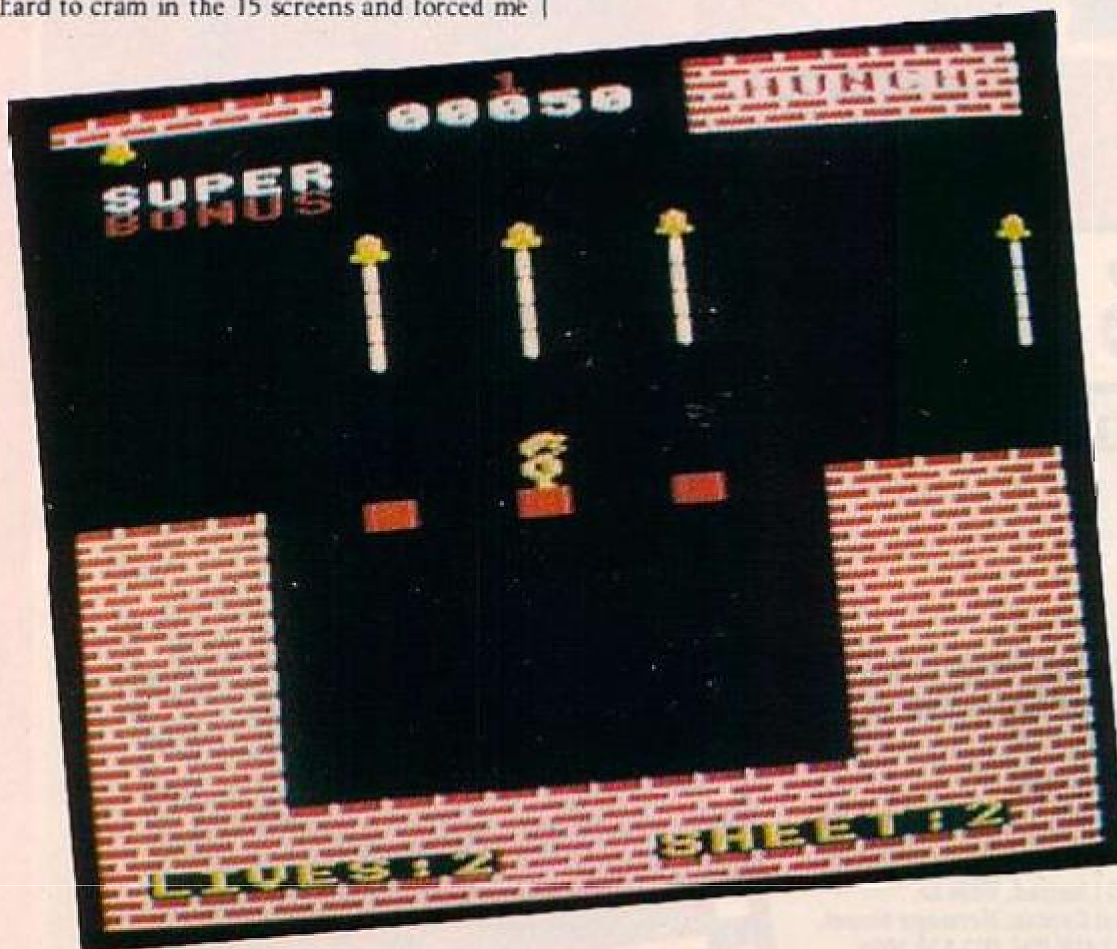
The program is written in Mode 5 as this provides a reasonable amount of memory a good resolution in four colours which is all that is needed to write an addictive arcade game. The game is written in machine code but other functions which do not require speed are written in Basic. All the screens are condensed thus making the listing quite short and this should aid you when you are typing it in. However this type of screen storage also has its disadvantages, a scrolling routine

(continued on page 67)

Program 1.

```
   10DATA16,48,112,112,96,32,16,48,192,240,160,96,16,3
2,192,192
   20DATA96,96,96,112,48,16,16,16,224,224,224,96,192,1
28,128,192
   30DATA16,48,112,112,96,32,16,48,192,240,160,96,16,3
2,192,192
   40DATA112,112,240,240,48,112,96,112,224,224,112,176
,192,96,224,112
   50DATA48,240,80,96,128,64,48,48,128,192,224,224,96,
64,128,192
   60DATA112,112,112,96,48,16,16,48,96,96,96,224,192,1
28,128,128
   70DATA48,240,80,96,128,64,48,48,128,192,224,224,96,
64,128,192
   80DATA112,112,224,208,48,96,112,224,224,224,240,240
,192,224,96,224
   90VDU23,128,254,254,254,0,239,239,239,0
  100VDU23,129,0,24,24,24,24,24,24,24
```

(program 1 continued on page 67,

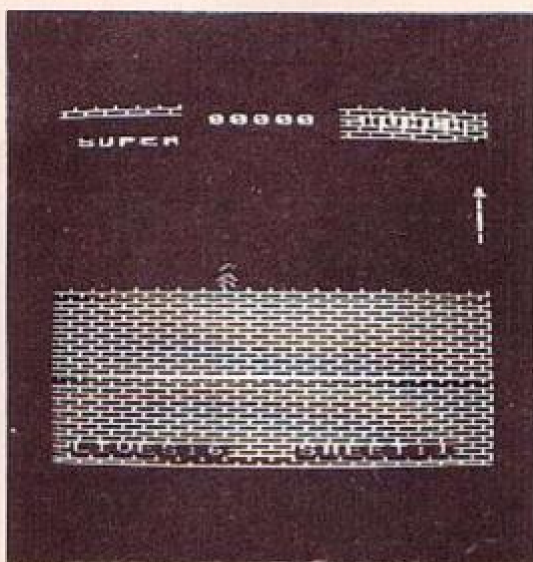


(continued from page 65)
would be impossible as there would be nothing to scroll onto but a plain brick wall whatever the sheet was.

Controlling Quasimodo

If you are looking for something to aim at in the way of scores then my personal best is 4,500. If you feel the need to design your own screens then you could change the "binary" numbers in the data statement at line 40 of listing 2 but remember that some of the combinations available offer no sort of challenge whatsoever — i.e. a flat brick wall with an arrow flying overhead — and there are few combinations I have not included in the 15 screens within the game. To control Quasimodo use the key Z — Left, X — Right, Shift — Jump, to take a run and jump press both a directional key and the jump key together.

As the game was written for the Electron BBC owners will find it too fast. To slow it down change the values of SP(1) and SP(2) in line 20. SP(1)=180 should slow the game down sufficiently.



(program 1 continued from page 65)

```
110VDU23,130,24,60,60,60,60,126,126,24
120VDU23,131,0,24,60,126,219,126,102,60
130VDU23,132,24,60,126,231,231,129,129,231
140VDU23,133,231,231,231,255,255,255,36,102
150VDU23,134,32,32,32,32,32,32,32,32
160VDU23,135,32,112,32,32,32,32,32,32
170VDU23,138,1,3,7,15,31,63,127,255
180VDU23,139,0,12,30,31,15,7,3,1
190VDU23,140,0,48,120,248,240,224,192,128
200ENVELOPE1,1,-90,-3,126,3,10,4,126,0,0,-126,126,12
6
210ENVELOPE2,2,-90,-3,126,3,10,4,126,0,0,-126,126,12
6
220ENVELOPE3,1,-90,3,-90,10,20,10,126,0,0,-126,126,1
26
230DATA1,0,3,0,1,0,2,0
240DATA0,0,0,4,15,4,0,0,0,1,2,2,15,2,2,1
250DATA1,0,2,0,255,0,25,0
260DATA0,0,0,0,0,0,0,0,1,18,32,112,48,8,20,18,14,15,
135,225,193,129,192,72,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,1,16,16,48,112,17,34,96,72,192,192,224,240,68,68,192,
0,0,0,0,0,0,0,0
270G%=&905:FORT=0TO223:READD:T?G%=D:NEXT
280MODE4:VDU19,0,4;0;
290PRINTTAB(13,3);"H U N C H Y"
300PRINT''"In this game game you play the HUNCH     BA
CK of NOTRE DAME.Your only true love  EZMERALDA has be
en imprisoned by the    evil soldiers."
310PRINT"Your task is to save her from their      clu
thches but this is not as easy as it sounds as you mus
t first clear FOURTEEN screens to reach her !"
320PRINT''"If you clear a screen then you gain a ";C
HR$130" If you have four ";CHR$130;"s then you will b
e given a SUPER BONUS."''"But if you lose just one lif
e you lose  all the bells !!"
330PRINT''"The controls are:-"''"Z - LEFT     X - RIGH
T        shift - JUMP"
340VDU28,0,31,39,26
350CHAIN"HUNCHY2"
>
```

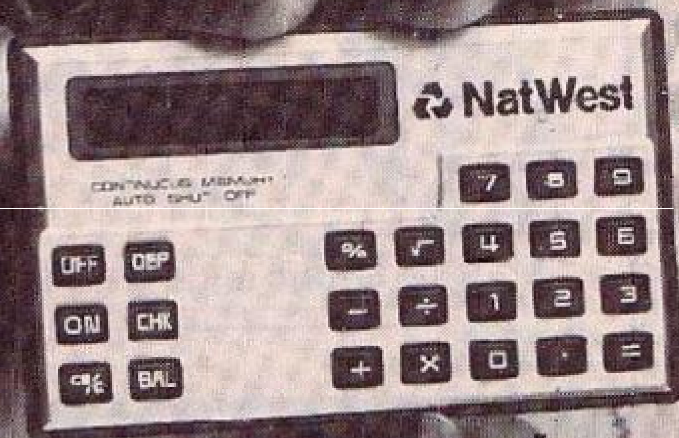
Program 2.

```
10*FX229,1
20DIMSc$(2),lives(2),sh(2),SP(2):Sc$(1)="00000":Sc$
(2)="00000":NUMPL=1:lives(1)=7:lives(2)=7:bells=-1:PL$
="ONE":sh(1)=0:sh(2)=0:SP(1)=140:SP(2)=140:PROCASSEM:P
Lnum=1:*FX15,1
30MODE4:PRINTTAB(6,10);"PRESS 1 OR 2 TO START THE G
AME";:A$=GET$:IF A$="2" NUMPL=2:PLnum=1
40DATA1000,0000,0010,0001,1110,1001,0110,0000,0101,
1100,0000,1010,1101,0000,1101,END
50RESTORE40
60MODE5:VDU23,1,0;0;0;0;
70PROCSTART
80bells=bells+1
90?(delay+1)=SP(PLnum)
100FORT=1TO4:T?&D4F=0:NEXT
110FORT=0TO4:T?&D54=VAL(MID$(Sc$(PLnum),(5-T),1)):NE
XT
120A%=?&D55:A%=A%-5:?&D55=A%:CALLscore
130RESTORE40:sh(PLnum)=sh(PLnum)+1:U%=sh(PLnum):FORT
=1TOU%:READD$:NEXT:IF D$="END" THEN GOSUB1520:FORT=0TO
5000:NEXT:RESTORE40:sh(PLnum)=0:GOTO60
140FORT%=1TOLEND$:T%?&D4F=VAL(MID$(D$,T%,1)):NEXT
150VDU17,1,17,131
160PRINTTAB(13,0);STRING$(7,CHR$128)TAB(13,1);CHR$12
8;"HUNCH";CHR$128TAB(13,2);STRING$(7,CHR$128);
170IF U%=15 THEN PROCEZ
180CALLwall:PRINTTAB(0,0);STRING$(6,CHR$128):VDU17,1
28,17,3,30
190PRINTTAB(1,3);"SUPER":COLOUR1:PRINTTAB(1,4);"BONU
S"TAB(9,0);PLnum:COLOUR3
200IF U%=15 THEN 230
210FORT%=0TO11:PRINTTAB(19,T%);CHR$129;:NEXT
220VDU17,2,31,19,7,130
230COLOUR2:PRINTTAB(1,29);"LIVES:";lives(PLnum) TAB(
11,29);"SHEET:";U%
240PRINTTAB(1,1);STRING$(bells,CHR$130):IF bells=4
THEN PROCBONUS
250IF ?&D53<>1 THEN 300
260COLOUR3
270FORT%=16TO18:PRINTTAB(3,T%);CHR$(115+T%);" "TAB(9
,T%);CHR$(115-T%);" "TAB(15,T%);CHR$(115+T%);" ";
280NEXT:COLOUR
290FORT%=15TO17:PRINTTAB(4,T%);CHR$134TAB(10,T%);CHR
$134TAB(16,T%);CHR$134:NEXT:PRINTTAB(4,14);CHR$135TAB(
10,14);CHR$135TAB(16,14);CHR$135;
300IF ?&D52<>1 THEN 330
310FORT%=16TO18:PRINTTAB(3,T%);"   "TAB(9,T%);"   "TAB
(15,T%);"   ";:NEXT
320PROCSHADOW
330IF D$="0000" PROCbells
340CALLH%:CLS:IF ?&D01=255 THEN 1330 ELSE CALLscore:
Sc$(PLnum)="":FORT=4TO0STEP-1:Sc$(PLnum)=Sc$(PLnum)+ST
R$(T?&D54):NEXT:GOTO80
350GOTO80
360DEFPROCASSEM
370G%=&905
380M1=G%:M2=G%+64:ez=&9A5
390DIMH%3000
400FORT=0TO2STEP2
410P%=H%
420[OPTT
430LDA#5:STA&70:LDA#9:STA&71
440LDA#&30:STA&72:LDA#&69:STA&73:LDA#0:STA&74:STA&75
:STA&D01:STA&D0A:STA&D0B:STA&7F:STA&60:LDA#&18:STA&7A:
LDA#&68:STA&7B
450LDA#&E0:STA&76:LDA#&6B:STA&77
460LDA&D51:CMP#1:BNENBT
470LDY#0:.QQ LDA&9BD,Y:STA(&7A),Y:INY:CPY#16:BNEQQ
480.NBT JSRdis:LDA&D50:CMP#1:BNEstart
490LDY#0:.qq LDA&7BD,Y:STA(&76),Y:INY:CPY#16:BNEqq
500SEC:LDA&D55:SBC#5:STA&D55:JSRscore
510.start CLC:LDA&72:ADC#&30:STA&4D:LDA&73:ADC#1:STA
&4E:LDY#0:.a LDA(&70),Y:STA(&72),Y:INY:CPY#16:BNEa:.b
LDA(&70),Y:STA(&4D),Y:INY:CPY#32:BNEb
520LDA&D50:CMP#1:BNENBB
530LDA&76:STA&6C:LDA&77:STA&6D:JSRobj:LDA&6C:STA&76:
LDA&6D:STA&77:.NBB
540LDA&D51:CMP#1:BNEnbt
550LDA&7A:STA&6C:LDA&7B:STA&6D:JSRobj:LDA&6C:STA&7A:
LDA&6C:STA&7B:.nbt
560LDA&D57:CMP#1:BNEio
570INC&D0E:LDA&D0B:CMP#8:BNEio:JSRmen:LDA#0:STA&D0D:
.io
580LDA&74:CMP#3E:BEQ1:JMPbag:.1 JMPfin:.bag
```

(continued on next page)

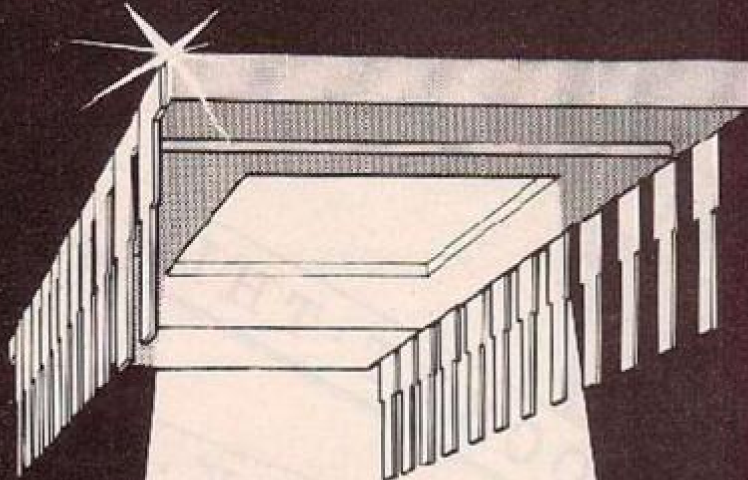
(continued from previous page)

```
590JSRdelay
600JSRSEE2:LDA&75:CMP#0:BNEf:JSRSEE:.f
610LDA&D01:CMP#&FF:BNEk:JMPdead:.k
620LDA&74:CMP#0:BEQc
630LDA#&81:LDX#&7E:LDY#&FF:JSR&FFF4:CPY#&FF:BNEc
640LDA#1:STA&60:JSRrub:DEC&74:SEC:LDA&72:SBC#8:STA&72:LDA&73:SBC#0:STA&73
650LDA#M2 MOD 256:STA&70:LDA#M2 DIV 256:STA&71:JSRani
660.c LDA&74:CMP#30:BEQd:LDA#&81:LDX#&DD:LDY#&FF:JSR&FFF4:CPY#&FF:BNEd
670LDA#M1 MOD 256:STA&70:LDA#M1 DIV 256:STA&71
680LDA#0:STA&60:JSRrub:JSRani:INC&74:CLC:LDA&72:ADC#8:STA&72:LDA&73:ADC#0:STA&73
690.d LDA&75:CMP#0:BNEe:LDA#&81:LDX#&FF:LDY#&FF:JSR&FFF4:CPY#&FF:BNEe:LDA#1:STA&75:LDA#0:STA&D00:LDA#7:LDX#&85:LDY#9:JSR&FFF1
700.e LDA&75:CMP#0:BEQg
710JSRjump
720.g JMPstart
730.rub CLC:LDA&72:ADC#&40:STA&4D:LDA&73:ADC#1:STA&4E:LDY#0:.A LDA#0:STA(&72),Y:STA(&4D),Y:INY:CPY#16:BNEA:RTS
740.delay LDX#150:.B LDY#00:.C DEY:BNEC:DEX:BNEB:RTS
750.jump INC&D00:LDA&D00:CMP#7:BNED
760LDA#0:STA&75:JMPSEE
770.D LDA&D00:CMP#4:BPLdown
780JSRrub:SEC:LDA&72:SBC#&40:STA&72:LDA&73:SBC#1:STA&73:JSRSEE3:RTS
790.down JSRrub:CLC:LDA&72:ADC#&40:STA&72:LDA&73:ADC#1:STA&73:JMPSEE3
800.obj LDY#0:.E LDA(&6C),Y:EOR&980,Y:STA(&6C),Y:INY:CPY#16:BNEE
810SEC:LDA&6C:SBC#8:STA&6C:LDA&6D:SBC#0:STA&6D
820LDY#0:.check LDA(&6C),Y:CMP#0:BNEhit:INY:CPY#16:BNEcheck:JMPnohit
830.hit AND#&0F:CMP#0:BNEnohit:LDA#&FF:STA&D01:.nohit:JMPedge1
840.G JMPedge2:.WW LDY#0:.H LDA(&6C),Y:EOR&980,Y:STA(&6C),Y:INY:CPY#16:BNEH
850RTS
860.edge1 LDA&6D:CMP#&5A:BEQF:JMPG
870.F LDA&6C:CMP#&C0:BNEuiW
880LDA#&F8:STA&6C:LDA#&6D:STA&6D:.uiW JMP G
890.edge2 LDA&6D:CMP#&67:BEQR:JMPWW
900.R LDA&6C:CMP#0:BNEre
910LDA#&30:STA&6C:LDA#&68:STA&6D:.re JMPWW
920.dead LDA#0:STA&76:STA&D03:STA&D05:STA&D07:STA&D07:LDA#2:STA&D04:LDA#&11:STA&D02:LDA#2:STA&D08:LDA#&FF:STA&D06
930.I JSRdis:LDA#7:LDX#2:LDY#&D:JSR&FFF1:LDY#0:.reset DEC&D06:INY:CPY#15:BNEreset:JSRdelay2:CLC:LDA&72:ADC#&40:STA&72:LDA&73:ADC#1:STA&73:JSRdis:JSRdelay2
940INC&76:LDA&76:CMP#15:BNEI
950RTS
960.dis CLC:LDA&72:ADC#&30:STA&4D:LDA&73:ADC#1:STA&4E:LDY#0:.J LDA(&72),Y:EOR(&70),Y:STA(&72),Y:INY:CPY#16:BNEJ:.K LDA(&4D),Y:EOR(&70),Y:STA(&4D),Y:INY:CPY#32:BNEK:RTS
970.delay2 LDX#50:.A1 LDY#50:.B1 DEY:BNEB1:DEX:BNEA1:RTS
980.fin LDA&D00:CMP#3:BEQrrs:JMPbag:.rrs LDA#7:LDX#&90:LDY#9:JSR&FFF1:LDY#0:.ttR TYA:PHA:JSRdelay:PLA:TAY:INY:CPY#10:BNEttR:LDA#21:LDX#5:JMP&FFF4
990.SEE CLC:LDA&72:ADC#&80:STA&4D:LDA&73:ADC#2:STA&4E:LDY#0:.tt LDA(&4D),Y:AND#15:CMP#0:BEQgg:CMP#2:BEQgg:INY:CPY#8:BNEtt:RTS
1000.gg LDA#&FF:STA&D01:RTS
1010.man LDA#17:JSR&FFEE:LDA#1:JSR&FFEE
1020LDA#4:STA&D0B:LDA#10:STA&D0C:LDA#16:STA&D0D:LDA&D0A:CMP#0:BEQsp3
1030LDY#0:.hw LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#14:JSR&FFEE:LDA#134:JSR&FFEE:LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#13:JSR&FFEE:LDA#135:JSR&FFEE
1040LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#17:JSR&FFEE:LDA#32:JSR&FFEE
1050INY:CPY#3:BNEhw:LDA#0:STA&D0A:RTS
1060.sp3 LDY#0:.hy LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#13:JSR&FFEE:LDA#32:JSR&FFEE:LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#14:JSR&FFEE:LDA#135:JSR&FFEE
1070LDA#31:JSR&FFEE:LDA&D0B,Y:JSR&FFEE:LDA#17:JSR&FFEE:LDA#134:JSR&FFEE:INY:CPY#3:BNEhy:LDA#1:STA&D0A:RTS
1080.SEE2 CLC:LDA&72:ADC#&40:STA&4D:LDA&73:ADC#1:STA&4E:LDY#0:.ty3 LDA(&4D),Y:AND#2:CMP#0:BNEHIT:INY:CPY#8:BNEty3:RTS
1090.HIT LDA#&FF:STA&D0:RTS
1100.SEE3 CLC:LDA&72:ADC#&40:STA&4D:LDA&73:ADC#1:STA&4E:LDY#0:.WEQ LDA(&4D),Y:CMP#2:BEQHIT:INY:CPY#16:BNEWEQ:RTS
1110.score LDA#17:JSR&FFEE:LDA#3:JSR&FFEE:LDA#31:JSR&FFEE:LDA#7:JSR&FFEE:LDA#1:JSR&FFEE:CLC:LDA&D55:ADC#5:STA&D55:CMP#10:BNESHOW:LDA#0:STA&D55
1120INC&D56:LDA&D56:CMP#10:BNESHOW:LDA#0:STA&D56:INC&D57:LDA&D57:CMP#10:BNESHOW:LDA#0:STA&D57
1130.SHOW LDY#4:.wwAA CLC:LDA&D54,Y:ADC#48:JSR&FFEE:DEY:CPY#&FF:BNEwwAA:RTS
1140.WOMAN LDA#&18:STA&72:LDA#&63:STA&73:LDA#&38:STA&4D:LDA#&64:STA&4E:LDY#0:.AS LDAez,Y:STA(&72),Y:INY:CPY#32:BNEAS:.YU LDAez,Y:STA(&4D),Y:INY:CPY#64:BNEYU:RTS
1150.wall SEI:LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#16:JSR&FFEE:LDX#0:.ff LDY#0:.yy LDA#126:JSR&FFEE:INY:CPY#150:BNEyy:INX:CPX#2:BNEff:CLI:RTS
1160.ani LDA&60:CMP#1:BEQan2:LDA&7F:CMP#0:BEQgf:LDA#0:STA&7F:LDA#&3:STA&70:RTS:.gf LDA#1:STA&7F:LDA#&25:STA&70:RTS
1170.ar2 LDA&7F:CMP#0:BEQfg:LDA#0:STA&7F:LDA#&45:STA&70:RTS:.fg LDA#1:STA&7F:LDA#&65:STA&70:RTS
1180.bit LDA#17:JSR&FFEE:LDA#1:JSR&FFEE:LDA#17:JSR&FFEE:LDA#131:JSR&FFEE:JSRWOMAN
1190LDA#0:STA&D51:STA&D53:STA&D55:STA&D57:LDA#&11:STA&D50:STA&D54:STA&D56:LDA#1:STA&D52
1200LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#10:JSR&FFEE:LDY#0:.kN LDA#120:JSR&FFEE:INY:CPY#20:BNEkN:LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#29:JSR&FFEE:LDY#0:.nK LDA#120:JSR&FFEE:INY:CPY#20:BNEnK:LDA#0:STA&74:STA&7F:STA&60:STA&72:LDA#&62:STA&73
1210LDA#17:JSR&FFEE:LDA#128:JSR&FFEE:LDA#17:JSR&FFEE:LDA#3:JSR&FFEE:LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#17:JSR&FFEE:LDY#0:.rts LDA&57C0,Y:JSR&FFEE:INY:CMP#13:BNErts
1220LDA#17:JSR&FFEE:LDA#2:JSR&FFEE:LDA#31:JSR&FFEE:LDA#7:JSR&FFEE:LDA#6:JSR&FFEE:LDY#0:.w3 LDA&57B0,Y:JSR&FFEE:INY:CMP#13:BNEw3:LDA#31:JSR&FFEE:LDA#17:JSR&FFEE:LDA#10:JSR&FFEE:LDA#32:JSR&FFEE
1230LDA#5:STA&70:LDA#9:STA&71:JSRdis
1240.walk JSRdelay:JSRdis:JSRani:JSRSOU:CLC:LDA&72:ADC#8:STA&72:LDA&73:ADC#0:STA&73:JSRdis:INC&74:LDA&74:CMP#34:BNEwalk:JSRdelay:JSRdelay:JSRdelay
1250LDA#0:STA&D51:STA&D53:STA&D55:STA&D57:LDA#&11:STA&D50:STA&D54:STA&D56:LDA#2:STA&D52
1260LDA#0:STA&74:.DROP JSRdelay:JSRdis:JSRani:JSRSOU:CLC:LDA&72:ADC#&40:STA&72:LDA&73:ADC#1:STA&73:JSRdis:INC&74:LDA&74:CMP#19:BNEDROP:LDA#34:STA&74
1270LDA#0:STA&D51:STA&D53:STA&D55:STA&D57:LDA#&11:STA&D50:STA&D54:STA&D56:LDA#1:STA&D52
1280JSRdis:LDA#&45:STA&70:LDA#7:STA&71:LDA#1:STA&60:JSRdis:.back JSRdelay:JSRdis:JSRani:JSRSOU:SEC:LDA&72:SBC#8:STA&72:LDA&73:SBC#0:STA&73:JSRdis:DEC&74:LDA&74:CMP#2:BNEback:RTS
1290.SOU LDA#7:LDX#&50:LDY#&D:JMP&FFF1
1300]
1310NEXT
1320ENDPROC
1330lives(PLnum)=lives(PLnum)-1:sh(PLnum)=sh(PLnum)-1:bells=0:A%=?&D55:A%=A%-5:?&D55=A%:CALLscore:IF lives(PLnum)=0 THEN 1370
1340IF NUMPL=2 AND PLnum=1 PLnum=2:PL$="TWO" ELSE IF NUMPL=2 AND PLnum=2 PLnum=1:PL$="ONE"
1350IF NUMPL=2 PROCSTART
1360GOTO90
1370*FX15,1
1380IF PLnum=1 THEN PRINT''''"GAME OVER PLAYER ONE":FORG=0TO5000:NEXT::CLS:IF NUMPL=2 AND lives(2)<>0 GOTO1340
1390IF PLnum=2 THEN PRINT'''"GAME OVER PLAYER TWO":FORT=0TO5000:NEXT:CLS
1400IF lives(1)<>0 THEN 1340
1410T%=0:lives(1)=7:lives(2)=7:bells=-1:PL$="ONE":sh(1)=0:sh(2)=0:P$=STRING$(20,".")+"PRESENTING HUNCHY BY BRIAN LEWIS.....................STARRING.....................QUAZIMODO.!!.AND.EZMERALDA...WITH...FULL...SUPPORTING...CAST...OF..."
1420P$=P$+"SOLDIERS.":Sc$(1)="0000":Sc$(2)="0000":PLnum=1:NUMPL=1:SP(1)=120:SP(2)=120
1430COLOUR1:A%=((U%-1)/15)*100:PRINTTAB(1,4);"YOU COMPLETED: ";A%;"%"TAB(1,6);"OF THE NOTRE DAME"'';SPC(4);"BATTLEMENTS"
1440COLOUR131:PRINTTAB(0,15);STRING$(20,CHR$128)TAB(0,19);STRING$(20,CHR$128);:COLOUR128:COLOUR3
1450PRINTTAB(2,2);"ANOTHER GO ?(Y/N)";:COLOUR2
1460PRINTTAB(0,17);MID$(P$,T%,20);:T%=T%+1:IFT%=178 THEN T%=1
1470A$=INKEY$(10):IF A$<>"" THEN1490
1480GOTO1460
1490IF A$="Y" THEN 30
1500IF A$<>"N" THEN 1460
1510CALL&D9D2
1520VDU13,19,0,10;0;:FORT%=1TO255STEP5:SOUND1,3,T%,1:NEXT
1530PRINT''"WELL DONE !!!"'''"BUT NOW TRY IT"'''"WHEN IT'S FASTER"
1540lives(PLnum)=lives(PLnum)+1:SP(PLnum)=SP(PLnum)-20:FORI%=1TO8:CALLscore:NEXT:Sc$(PLnum)="":FORT=4TO0STEP-1:Sc$(PLnum)=Sc$(PLnum)+STR$(T?&D54):NEXT:RETURN
1550DEFPROCEZ:PRINTTAB(17,10);STRING$(3,CHR$128);:FORT%=5TO9:PRINTTAB(17,T%);CHR$128;:NEXT
1560COLOUR128:PRINTTAB(18,6);CHR$139;CHR$140:COLOUR131
1570CALLWOMAN
1580ENDPROC
1590DEFPROCSHADOW:COLOUR131:FORT%=17TO18:PRINTTAB(4,T%);" "TAB(10,T%);" "TAB(16,T%);" ";:NEXT:COLOUR128:COLOUR3:PRINTTAB(4,16);CHR$138TAB(10,16);CHR$138TAB(16,16);CHR$138;:ENDPROC
1600DEFPROCBONUS:COLOUR1:PRINTTAB(7,15);"BONUS":SOUND&11,3,1,255:FORG=0TO1000:NEXT
1610*FX21,5
1620FORT%=1TO4:PRINTTAB(T%,1);" ";:SOUND&11,1,255,4:FORG=0TO200:NEXT,:FORG=0TO200:NEXT
1630bells=0:PRINTTAB(7,15);"     ":CALLscore:CALLscore:Sc$(PLnum)="":FORT=4TO0STEP-1:Sc$(PLnum)=Sc$(PLnum)+STR$(T?&D54):NEXT:ENDPROC
1640DEFPROCbells:FORT%=14TO26:PRINTTAB(4,T%);STRING$(11," ");:NEXT:IF U%=8 ?&D50=1 ELSE IF U%=14 ?&D50=1:?&D51=1 ELSE IF U%=11 ?&D51=1
1650COLOUR129:PRINTTAB(6,16);" "TAB(9,16);" "TAB(12,15);" ":COLOUR128
1660COLOUR3:FORT%=7TO10:PRINTTAB(6,T%);CHR$129TAB(9,T%);CHR$129TAB(12,T%);CHR$129;:NEXT:COLOUR2:PRINTTAB(6,6);CHR$130TAB(9,6);CHR$130TAB(12,6);CHR$130:ENDPROC
1670DEFPROCSTART:$&57C0="GET READY PLAYER "+PL$:$&57B0="HUNCHY":FORT%=0TO4:T%?&57F0=T%?&D54:NEXT:CALLbit
1680*FX21,5
1690FORT%=0TO4:T%?&D54=T%?&57F0:NEXT:FORG=0TO2000:NEXT:CLS:ENDPROC
```


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Oric 1 computer 48K £85 (£82) £92. Oric Atmos computer 48K £171 (£158) £168. CCP40 Oric colour printer £124 (£115) £132. Sinclair flat screen TV £110 (£105) £115. Sinclair Spectrum Plus Computer £182 (£176) £187. Sinclair QL Computer £486 (£385) £410. Sinclair Spectrum 48K £131 (£121) £143. Microdrive £51 (£50) £60. RS232 interface 1 £51 (£50) £60. Special offer Microdrive + Interface 1 + 4 cartridges £102 (£100) £120. Blank microdrive cartridges £5.50 (£6) £7. Standard floppy disc interface for Spectrum £102 (£92) £112. (See Cumana disc section for suitable disc drives). Fuller FDC keyboard for Spectrum £52 (£52) £62. Fuller master unit £56 (£56) £62. Interface 2 £20.45 (£20) £21. 32K memory upgrade kit for 16K Spectrum (issue 2 and 3 only) £31 (£26) £30. Spectrum Centronics printer interface £51 (£47) £52. ZX printer has been replaced by the Alphacom 32 £71 (£69) £82. 5 printer rolls (state whether Sinclair or Alphacom) £13 (£16) £21. ZX computer £46 (£41) £54. 16K ram packs for ZX81 £28 (£25) £30.

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Commodore C16 Starter Pack £145 (£142) £162. Commodore Plus/4 £305 (£281) £301. Commodore 64 £222 (£215) £235. Convertor to allow most ordinary micro cassette recorders to be used with the Vic 20 and the Commodore 64 £9.78 (£9) £11. Bargain package: cassette convertor + compatible cassette recorder £37 (£38) £47. Commodore cassette recorder £40 (£44) £50. Printer interfaces for Vic20 and the Commodore 64: Centronics £45 (£41) £46. RS232 £45 (£41) £46. Disc drive £232 (£208) £234. 1520 printer/plotter £165 (£149) £159. MPS801 Printer £235 (£220) £245. Light pen £25 (£20) £33.

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To suit disc interfaces of Sinclair Spectrum, BBC B and Videogenie. Single: 40 track single sided £175 (£158) £178, 40 track double sided £218 (£195) £215, 80 track single sided £207 (£186) £206. 80 track double sided £234 (£209) £229. Dual: 40 track single sided £299 £280 £320, 40 track double sided £395 (£353) £383, 80 track single sided £372 (£334) £374, 80 track double sided £437 (£390) £430.

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Oki Microline 80 £138 £135 £165. Brother HR5 £162 (£146) £170. Shinwa CT CP-80 £237 (£228) £258. Cannon PW1080A £382 (£344) £374. Epson RX80 £277 (£251) £282. Epson RX80F/T £314 (£286) £316. Epson FX80 £308 (£280) £326. Combined matrix printers and electric typewriters Brother EP22 £173 (£166) £186. Brother EP44 £256 (£235) £260. CCP40 Oric Colour printer/plotter £124 (£115) £132. Interfaces to run the above printers from Vic and the Commodore 64 £45 (£41) £46. We can supply interfaces to run the above printers from Sharp computers £56 (£50) £56.

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G Barbour with a machine code sprite editor for the CBM-64.

SUPER EDITOR

MOST COMMODORE 64 users *do* have a Sprite Editor, but these are usually written in Basic. Super-Editor is written completely in machine code and resides in a part of memory not used by Basic or sprites — C000 to D000. Super-Editor can be loaded into memory and left there oblivious to any Basic program. It can then be called up by a simple Sys command when needed. This means that you can program, edit sprites and continue programming without losing your Basic program.

Program 1 is the main program and must be entered, leaving out the Rem statement at the end of each line. These will be used to check that the program has been correctly entered. After being entered, program 1 must be saved. Program 2 must be entered while program 1 is still in memory.

Now type Run 50000. On the screen will appear: 200 . . . followed by a value.

You must check that this value is the same as the value in the Rem statement which corresponds to line 200. If it is correct, press any key and the program will go on to the next line. When all lines have been checked, the program will stop with an Out of Data error. If the values do not correspond, press Run Stop and check that line. After correcting the line Run 50000 again. When all errors have been corrected, erase program 2 and Save the program.

To activate the program type
SYS 49280

You are now in the main screen.

On the left of the screen will be a 24 by 21 grid, surrounded by a checked border. On the grid will be displayed the current sprite and shortly after that a flashing cursor will appear in the top left corner of the grid. At the botton right side of the screen will appear the current sprite in normal size.

In the top right hand corner of the screen will be displayed:

(i) The current sprite number.
(ii) The color of the current sprite.
(iii) The type of sprite. N = Normal M = Multi-colored.

The flashing cursor can be moved around using the cursor keys.

Clear will clear the grid.

Home will position the cursor at the top left corner.

. (Period) plots a dot.

Space will clear a dot — un-plots it.

C will increase the color value to the next higher value.

T will change the sprite type from normal to multi-colored or vice versa

\+ will display the next sprite.

\- will display the previous sprite.

F1 will display the menu page.

Run Stop will return you to Basic.

The Menu Page will display five functions:

1 STORE DATA
2 INPUT DATA
3 TRANSFER
4 SEARCH
5 GOTO

The computer will wait for you to press one of these numbers, 1 to 5.

STORE DATA: The screen will clear and when prompted, you must enter the first sprite that you wish to be saved followed by the last sprite that you wish to be saved.

After this a sub-menu will be displayed asking whether to store to disc, tape or program lines.

If you choose disc or tape, you will be asked to enter a file name. When the computer has finished saving it will return to the main screen.

If you choose program lines, you will be asked to stipulate the line at which to start the data. In this case the last sprite is ignored as only the first sprite will be stored. The values for this sprite are stored in data statements which are read by the Basic read command. The first value is the address of the sprite. To Poke the sprite into memory, have a line similar to:

10 READ AD: FOR
I = OTO62:READX:POKEAD + 1,X:NEXTI

Once the computer is finished storing the data, it will return to the main screen.

INPUT DATA: This function allows you to load sprite data into memory. When prompted, you must enter the device number and the file name.

TRANSFER: This allows the data from one sprite to be transferred to another. The parameters that must be entered are the

(continued on next page)

Program 1.

```
1 A=49152
2 READB:IFB=-1THENPRINT"{CLR}SYS49280":NEW
3 POKEA,B:A=A+1:GOTO2
200 DATA160,0,185,80,3,141,64,3,185:REM 4033
201 DATA81,3,141,65,3,200,200,117,0:REM 473?
202 DATA141,66,3,141,67,3,141,68,3:REM 2757
203 DATA141,69,3,162,15,14,64,3,46:REM 1981
204 DATA65,3,224,248,173,66,3,109,65:REM 4513
205 DATA3,141,66,3,173,67,3,109,67:REM 3258
206 DATA3,141,67,3,173,68,3,109,68:REM 3274
207 DATA3,141,68,3,216,234,202,16,216:REM 6471
208 DATA162,2,189,66,3,72,74,74,74:REM 3220
209 DATA74,32,104,192,104,41,15,32,104:REM 3281
210 DATA192,202,16,236,169,0,32,210,255:REM 6632
211 DATA192,2,144,188,96,208,27,3,200:REM 3337
212 DATA4,169,1,208,5,9,48,141,59:REM 3347
213 DATA3,76,210,255,255,127,255,255,255:REM 9962
214 DATA0,106,76,65,193,24,76,240,255:REM 6548
215 DATA144,32,32,32,32,32,32,32,32:REM 1552
216 DATA32,32,32,32,32,32,85,83,80:REM 2655
217 DATA69,82,45,69,68,73,84,79,82:REM 3380
218 DATA13,32,32,32,32,32,32,32,32:REM 1421
219 DATA32,32,32,32,32,32,163,163,163:REM 4584
220 DATA163,163,163,163,163,163,163,163,163:REM 7335
221 DATA13,32,32,32,32,32,32,32,32:REM 1421
222 DATA32,32,32,32,32,32,32,32,32:REM 1440
223 DATA32,32,66,89,32,32,32,32,32:REM 1770
224 DATA13,32,32,32,32,32,32,32,32:REM 1421
225 DATA32,32,32,32,32,32,32,32,32:REM 1440
226 DATA32,32,183,183,32,32,32,32,32:REM 2357
227 DATA13,13,13,32,32,32,32,32,32:REM 1326
228 DATA32,32,32,32,32,32,32,32,32:REM 1440
229 DATA32,71,46,66,65,82,65,79,85:REM 3252
230 DATA82,32,32,13,32,32,32,32,32:REM 1414
231 DATA32,32,32,32,32,32,32,32,32:REM 1440
232 DATA32,32,163,163,163,163,163,163,163:REM 6942
233 DATA163,163,32,32,13,13,13,13,80:REM 1771
234 DATA82,69,83,83,32,65,73,89,32:REM 2897
235 DATA75,69,89,0,169,147,32,210,255:REM 6406
236 DATA169,5,141,32,208,141,33,208,160:REM 5951
237 DATA0,185,135,192,32,210,255,200,201:REM 8157
238 DATA0,208,245,32,228,255,201,0,240:REM 7516
239 DATA249,76,251,193,0,147,144,166,166:REM 6638
240 DATA166,166,166,166,166,166,166,166,166:REM 7470
241 DATA166,166,166,166,166,166,166,166,166:REM 7470
242 DATA166,166,166,166,166,166,13,0,166:REM 5071
243 DATA186,186,186,186,186,186,186,186,186:REM 8370
244 DATA186,186,186,186,186,186,186,186,186:REM 8370
245 DATA186,186,186,186,186,186,166,0,144:REM 6264
246 DATA166,166,166,166,166,166,166,166,166:REM 7470
247 DATA166,166,166,166,166,166,166,166,166:REM 7470
248 DATA166,166,166,166,166,166,166,166,0:REM 5976
249 DATA160,0,185,180,193,32,210,255,200:REM 7582
250 DATA201,0,208,245,162,0,234,160,0:REM 5833
251 DATA185,130,193,32,210,255,200,201,0:REM 6740
252 DATA208,245,169,13,32,210,255,232,224:REM 8234
253 DATA21,208,232,169,255,133,253,169,80:REM 7725
254 DATA133,254,160,0,185,157,193,32,210:REM 6485
255 DATA255,200,201,0,208,245,169,19,32:REM 5391
256 DATA210,255,96,32,185,193,76,232,194:REM 7355
257 DATA200,78,1,1,1,0,1,1,9:REM 383
258 DATA0,0,169,0,141,8,194,141,9:REM 3827
259 DATA194,32,207,255,201,13,240,81,201:REM 7119
260 DATA30,144,245,201,58,176,241,41,15:REM 5353
261 DATA170,173,8,194,141,10,194,173,9:REM 4904
262 DATA194,141,11,194,14,8,194,46,9:REM 3210
263 DATA194,14,8,194,46,9,194,24,173:REM 4413
264 DATA8,194,109,10,194,141,8,194,173:REM 5744
265 DATA9,194,109,11,194,141,9,194,14:REM 4378
266 DATA8,194,46,9,194,138,24,138,24:REM 3856
267 DATA109,8,194,141,8,194,169,0,109:REM 4639
268 DATA9,194,141,9,194,76,20,194,96:REM 4838
269 DATA160,0,169,29,32,210,255,200,192:REM 7316
270 DATA26,208,246,96,134,251,132,252,160:REM 8120
271 DATA0,177,251,32,210,255,200,201,0:REM 6823
272 DATA208,246,169,13,32,210,255,96,32:REM 5520
273 DATA35,83,85,80,69,82,45,69,68:REM 3062
274 DATA73,84,79,82,0,32,32,32,32:REM 1766
275 DATA32,32,66,89,0,32,32,32,32:REM 1747
276 DATA71,46,66,65,82,66,79,85,82:REM 3398
277 DATA0,0,32,144,83,80,82,73,84:REM 3481
278 DATA69,35,0,32,88,32,32,32,69:REM 2180
279 DATA0,32,67,79,76,79,85,82,35:REM 3001
280 DATA0,32,83,80,82,73,84,69,32:REM 2959
281 DATA0,0,32,70,49,32,70,79,82:REM 2673
282 DATA32,77,69,78,85,0,169,19,32:REM 2753
283 DATA210,255,32,109,194,162,144,160,194:REM 7228
284 DATA32,122,194,32,109,194,162,159,160:REM 6541
285 DATA194,32,122,194,32,109,194,162,163:REM 6330
286 DATA160,194,32,122,194,32,109,194,162:REM 6057
287 DATA182,160,194,32,122,194,32,109,194:REM 5828
288 DATA162,183,160,194,32,122,194,32,109:REM 5271
289 DATA194,162,193,160,194,32,122,194,32:REM 5593
290 DATA109,194,162,200,160,194,32,122,194:REM 6593
291 DATA32,109,194,162,209,160,194,32,122:REM 6197
292 DATA194,32,109,194,162,218,160,194,32:REM 6439
293 DATA122,194,32,109,194,162,219,160,194:REM 7543
294 DATA32,122,194,24,160,35,162,4,32:REM 3410
295 DATA240,255,173,1,194,141,80,3,169:REM 3194
296 DATA0,141,81,3,32,0,192,24,160:REM 3673
297 DATA35,162,6,32,240,255,173,3,194:REM 6232
298 DATA141,80,3,169,0,141,81,3,32:REM 2711
299 DATA0,192,24,160,29,162,8,32,240:REM 4664
300 DATA255,173,5,194,141,80,3,32,0:REM 2848
301 DATA192,24,160,33,162,5,32,240,255:REM 6131
302 DATA173,4,194,141,80,3,32,0,192:REM 3697
303 DATA24,160,34,162,7,32,240,255,173:REM 6398
304 DATA2,194,32,210,255,169,4,141,21:REM 4960
305 DATA208,141,16,208,173,1,194,141,250:REM 6977
306 DATA7,173,5,194,141,40,208,159,230:REM 6697
307 DATA141,5,208,169,0,141,4,208,173:REM 5546
308 DATA2,194,201,77,240,8,169,0,141:REM 5001
309 DATA28,208,76,220,195,169,4,141,28:REM 4961
310 DATA208,173,5,194,105,1,141,29,230:REM 4961
311 DATA56,173,4,194,105,1,141,23,208:REM 4764
312 DATA169,41,133,251,169,4,133,252,169:REM 6791
313 DATA1,141,6,194,141,7,194,32,14:REM 3564
314 DATA196,169,41,133,69,169,4,133,70:REM 4273
315 DATA76,139,197,234,173,1,194,133,73:REM 5851
316 DATA169,0,133,74,160,0,6,73,38:REM 2632
317 DATA74,24,200,192,6,208,246,165,73:REM 5770
318 DATA169,0,133,251,169,160,133,252,177:REM 7917
319 DATA73,32,156,196,200,192,63,208,246:REM 7860
320 DATA169,54,133,1,169,0,133,251,169:REM 5985
321 DATA160,133,252,169,41,133,73,169,4:REM 4760
322 DATA133,74,24,160,1,162,1,32,240:REM 4393
323 DATA255,162,1,160,0,177,251,201,1:REM 5658
324 DATA240,8,169,186,32,210,255,76,117:REM 6373
325 DATA196,169,18,32,210,255,169,32,32:REM 5023
326 DATA210,255,169,146,32,210,255,200,192:REM 8344
327 DATA24,208,222,169,13,32,210,255,159:REM 7870
328 DATA24,32,210,255,24,165,251,105,24:REM 5666
329 DATA133,251,165,252,105,0,133,252,232:REM 7698
330 DATA224,21,208,192,169,55,133,1,96:REM 4638
331 DATA0,141,155,196,138,72,152,72,173:REM 5850
332 DATA155,196,162,0,160,0,169,0,14:REM 3142
333 DATA155,196,105,0,24,145,251,200,192:REM 6437
334 DATA8,208,241,24,165,251,105,8,133:REM 5579
335 DATA251,144,2,230,252,104,168,104,170:REM 6887
336 DATA96,0,234,169,0,133,251,169,176:REM 6965
337 DATA133,252,169,41,133,73,169,4,133:REM 4823
338 DATA74,162,0,160,0,177,73,201,160:REM 5659
339 DATA240,7,169,0,145,251,76,240,196:REM 7208
340 DATA169,1,145,251,200,192,24,208,234:REM 7700
341 DATA24,165,73,105,40,133,73,165,74:REM 4488
342 DATA105,0,133,74,24,165,251,105,24:REM 4723
343 DATA133,251,165,252,105,0,133,252,232:REM 7698
344 DATA224,25,208,201,173,1,194,133,251:REM 7254
345 DATA169,0,133,252,160,3,6,251,38:REM 4768
346 DATA252,24,200,192,6,208,246,169,0:REM 6029
347 DATA133,73,169,176,133,74,169,54,133:REM 5411
348 DATA1,162,0,169,0,141,201,196,160:REM 6262
349 DATA0,14,201,196,24,177,73,109,201:REM 5788
350 DATA196,141,201,196,200,192,8,208,239:REM 7888
351 DATA138,168,173,201,196,145,251,152,170:REM 8150
352 DATA24,165,73,105,8,133,73,165,74:REM 4328
353 DATA105,0,133,74,232,224,64,208,210:REM 7306
354 DATA169,55,133,1,173,1,194,141,250:REM 6289
355 DATA7,96,173,1,194,133,251,169,0:REM 5599
356 DATA133,252,160,0,6,251,38,252,24:REM 5151
357 DATA200,192,6,208,246,96,234,169,255:REM 8525
358 DATA133,53,169,37,133,54,32,228,255:REM 6226
359 DATA201,0,208,27,198,53,165,53,201:REM 5629
360 DATA255,208,241,198,54,165,54,201,255:REM 7727
361 DATA208,233,160,0,177,69,73,128,145:REM 7?93
362 DATA69,76,139,197,160,0,72,177,69:REM 4767
363 DATA201,250,240,11,201,32,208,1,169:REM 5727
364 DATA160,145,69,76,206,197,169,122,145:REM 6637
365 DATA69,104,201,147,240,38,201,3,240:REM 6487
366 DATA37,201,68,240,36,201,32,240,35:REM 5380
367 DATA201,29,240,34,201,157,240,33,201:REM 6815
368 DATA17,240,32,201,145,240,31,201,19:REM 5558
369 DATA240,30,76,225,198,76,138,197,76:REM 6170
370 DATA21,198,76,38,198,76,99,198,76:REM 5204
371 DATA111,198,76,155,198,76,169,198,76:REM 5504
372 DATA172,198,76,198,198,76,222,198,0:REM 6172
373 DATA32,117,197,160,0,169,0,145,251:REM 5936
374 DATA200,192,64,208,247,76,232,194,169:REM 7996
375 DATA147,32,210,255,160,0,185,57,198:REM 6154
376 DATA32,210,255,200,201,0,208,245,96:REM 7363
377 DATA83,85,80,69,82,32,69,68,73:REM 3055
378 DATA84,79,82,32,66,89,32,71,82:REM 3010
379 DATA65,72,65,77,32,66,65,82,66:REM 2973
380 DATA79,85,82,13,13,71,79,79,68:REM 2835
381 DATA32,66,89,69,46,0,169,160,160:REM 4040
382 DATA0,145,69,32,207,196,76,123,198:REM 6105
383 DATA169,122,160,0,145,69,32,207,196:REM 5636
384 DATA76,123,198,173,7,194,201,24,240:REM 6566
385 DATA16,24,230,59,165,70,105,0,133:REM 4207
386 DATA70,24,238,7,194,76,148,197,76:REM 5802
387 DATA148,197,173,7,194,201,1,240,246:REM 7466
388 DATA206,7,194,198,69,165,69,201,255:REM 7315
389 DATA208,233,198,70,76,148,197,173,6:REM 5637
390 DATA194,201,21,240,223,238,6,194,24:REM 5972
391 DATA165,69,105,40,133,69,165,70,105:REM 4517
392 DATA0,133,70,76,148,197,173,6,194:REM 5707
393 DATA201,1,240,197,206,6,194,24,165:REM 5812
394 DATA69,233,39,133,69,176,185,198,70:REM 6094
395 DATA76,148,197,76,232,194,201,67,240:REM 7694
396 DATA23,201,84,240,22,201,71,240,21:REM 5573
397 DATA201,43,240,20,201,45,240,19,201:REM 6003
398 DATA133,240,18,76,148,197,76,14,199:REM 5328
399 DATA76,76,199,76,100,199,76,115,199:REM 6098
400 DATA76,144,199,76,7,200,238,5,194:REM 5952
401 DATA173,5,194,201,16,208,5,169,0:REM 4384
402 DATA141,5,194,173,5,194,141,41,208:REM 5801
403 DATA24,160,35,162,4,32,240,255,169:REM 6560
404 DATA32,32,210,255,32,210,255,24,160:REM 6585
405 DATA35,162,4,32,240,255,173,5,194:REM 6232
406 DATA141,80,3,169,0,141,81,3,32:REM 2711
407 DATA0,192,76,148,197,173,2,194,201:REM 6602
408 DATA78,240,9,169,78,141,2,194,76:REM 4747
409 DATA232,194,0,169,77,141,2,194,76:REM 4777
410 DATA232,194,32,117,197,160,0,177,251:REM 6804
411 DATA73,255,145,251,200,192,64,208,245:REM 8491
412 DATA76,232,194,238,1,194,24,160,35:REM 5006
413 DATA162,4,32,240,255,169,32,32,210:REM 5885
414 DATA255,32,210,255,32,210,255,76,232:REM 7870
415 DATA194,206,1,194,24,160,35,162,4:REM 4342
416 DATA32,240,255,169,32,32,210,255,32:REM 6105
417 DATA210,255,32,210,255,76,232,194,147:REM 7386
418 DATA29,29,29,29,29,29,29,29,29:REM 1305
419 DATA29,29,29,42,83,85,80,69,82:REM 3117
420 DATA45,69,68,73,84,79,82,32,77:REM 3096
421 DATA69,78,85,42,13,13,13,45,41:REM 1643
422 DATA32,83,84,79,82,69,32,66,65:REM 2943
423 DATA84,65,13,50,41,32,73,78,80:REM 2705
424 DATA85,84,32,68,65,84,65,13,51:REM 2468
425 DATA41,32,84,83,65,78,83,70,69:REM 3240
426 DATA82,13,52,41,32,83,69,65,82:REM 2827
427 DATA67,72,13,53,41,32,71,79,84:REM 2744
428 DATA79,3,0,160,0,185,169,199,32:REM 4913
429 DATA210,255,200,201,0,208,245,32,228:REM 7395
430 DATA255,201,0,240,249,201,52,240,16:REM 6496
431 DATA201,53,240,15,201,49,240,14,201:REM 5987
432 DATA51,240,13,201,50,240,12,76,62:REM 4314
433 DATA200,76,137,200,76,224,200,76,100:REM 6195
434 DATA203,76,199,203,160,0,140,250,7:REM 5607
435 DATA152,72,169,147,32,210,255,104,141:REM 6697
436 DATA80,3,72,169,0,141,81,3,32:REM 2733
437 DATA0,192,32,228,255,201,0,240,249:REM 8034
438 DATA201,88,240,15,104,168,200,192,0:REM 5621
439 DATA208,215,169,147,32,210,255,76,96:REM 6410
440 DATA193,104,169,147,32,210,255,76,96:REM 6173
441 DATA193,147,71,79,84,79,32,83,80:REM 3518
442 DATA82,73,84,69,32,35,0,160,0:REM 2436
443 DATA185,122,200,32,210,255,200,201,0:REM 6745
444 DATA208,245,32,12,194,173,8,194,141:REM 5727
445 DATA1,194,76,96,193,147,83,84,65:REM 4686
446 DATA82,84,32,83,80,82,73,84,69:REM 3374
447 DATA58,0,69,78,68,32,83,80,82:REM 3068
448 DATA73,84,69,58,0,147,49,41,32:REM 2521
449 DATA68,73,83,75,13,50,41,32,84:REM 2427
450 DATA65,80,69,13,51,41,32,76,73:REM 2474
451 DATA78,69,32,78,85,77,66,69,32:REM 3263
452 DATA83,6,0,0,166,0,135,162,230:REM 5774
453 DATA32,210,255,200,234,0,208,245,32:REM 6726
454 DATA12,194,173,1,194,141,222,200,173:REM 7450
455 DATA8,194,141,1,194,32,117,197,165:REM 5865
456 DATA251,133,67,165,252,133,68,169,13:REM 5381
457 DATA32,210,255,160,0,185,177,200,32:REM 6094
458 DATA210,255,200,201,0,208,245,32,12:REM 5451
459 DATA194,172,8,194,200,140,1,194,32:REM 5025
460 DATA117,197,165,251,133,73,165,252,133:REM 7481
461 DATA74,160,0,185,189,200,32,210,255:REM 7478
462 DATA200,201,0,208,245,32,228,255,201:REM 8396
463 DATA0,240,249,201,49,240,11,201,50:REM 5051
464 DATA240,10,201,51,240,9,76,57,201:REM 5134
465 DATA76,129,201,76,171,201,76,52,202:REM 6068
466 DATA147,70,73,76,69,78,65,77,69:REM 3315
467 DATA58,0,160,0,185,90,201,32,210:REM 5556
468 DATA255,200,201,0,208,245,160,0,32:REM 5176
469 DATA207,255,153,80,207,200,201,13,208:REM 7114
470 DATA245,136,96,32,101,204,152,72,169:REM 5805
471 DATA1,162,8,160,1,32,186,255,104:REM 5464
472 DATA162,80,160,207,32,189,255,166,73:REM 6606
473 DATA170,165,74,168,169,67,32,216,255:REM 6888
474 DATA173,222,200,141,1,194,76,96,193:REM 5987
475 DATA32,101,201,152,72,169,1,162,1:REM 4131
476 DATA160,1,32,186,255,169,13,32,210:REM 5528
477 DATA255,104,162,80,160,207,32,189,255:REM 7342
478 DATA165,73,170,165,74,168,169,67,32:REM 4866
479 DATA216,255,173,222,200,141,1,194,76:REM 6222
480 DATA96,193,83,65,84,65,0,160,0:REM 3836
481 DATA185,218,201,32,210,255,200,201,0:REM 6940
482 DATA208,245,76,159,19,32,210,255,169:REM 6980
483 DATA42,133,193,169,13,141,119,2,141:REM 4567
484 DATA120,2,96,83,39,83,0,160,0:REM 2967
485 DATA185,255,201,32,210,255,200,201,0:REM 7014
486 DATA208,245,76,173,80,3,201,0,240:REM 5663
487 DATA3,76,0,192,169,48,32,210,255:REM 6233
488 DATA96,147,83,84,65,82,84,73,78:REM 3666
489 DATA71,32,76,73,78,69,32,35,0:REM 1963
490 DATA0,0,160,0,169,7,141,51,202:REM 4580
491 DATA185,33,202,32,210,255,200,201,0:REM 6573
492 DATA208,245,32,12,194,173,8,194,133:REM 5650
493 DATA73,173,9,194,133,74,169,147,32:REM 4978
494 DATA210,255,169,17,32,210,255,32,210:REM 6646
495 DATA255,173,8,194,141,80,3,173,9:REM 4072
496 DATA194,141,81,3,32,0,192,32,223:REM 4498
497 DATA201,165,67,141,80,3,165,68,141:REM 4632
498 DATA81,3,32,0,192,169,13,32,210:REM 4394
499 DATA255,32,3,202,169,151,141,80,3:REM 4541
500 DATA169,202,141,81,3,32,0,192,76:REM 3747
501 DATA237,201,24,165,73,105,10,133,73:REM 4157
502 DATA165,74,105,0,133,74,24,162,0:REM 3201
503 DATA142,80,202,169,147,32,210,255,169:REM 7482
504 DATA17,32,210,255,32,210,255,24,165:REM 6613
505 DATA73,105,10,133,73,165,74,105,0:REM 3558
506 DATA133,74,165,73,141,80,3,165,74:REM 4260
507 DATA141,81,3,32,0,192,32,223,201:REM 5409
508 DATA160,3,177,67,141,80,3,169,0:REM 3517
509 DATA141,81,3,152,72,32,17,202,169:REM 4728
510 DATA44,32,210,255,104,168,200,204,51:REM 6777
511 DATA202,208,228,177,67,141,80,3,32:REM 4053
512 DATA17,202,24,165,67,105,8,133,67:REM 3841
513 DATA165,68,105,0,133,68,174,50,202:REM 5125
514 DATA232,142,50,202,169,13,32,210,255:REM 5596
515 DATA32,3,202,169,38,141,80,3,169:REM 4461
516 DATA203,141,81,3,32,0,192,76,237:REM 4988
517 DATA201,174,50,202,224,8,240,15,224:REM 6491
518 DATA9,240,8,76,167,202,169,6,141:REM 5347
519 DATA51,202,76,167,202,173,222,200,141:REM 7822
520 DATA1,193,76,96,193,147,84,82,65:REM 4677
521 DATA78,83,70,69,82,32,83,80,82:REM 3291
522 DATA73,84,69,32,35,0,84,79,32:REM 2299
523 DATA83,80,82,73,84,69,32,35,0:REM 2119
524 DATA160,0,185,69,203,32,210,255,200:REM 7508
525 DATA201,0,208,245,32,12,194,173,1:REM 4789
526 DATA194,141,222,200,173,8,194,141,1:REM 5590
527 DATA194,32,117,197,165,251,133,253,165:REM 8168
528 DATA252,133,254,160,0,185,88,203,200:REM 7070
529 DATA32,210,255,201,0,208,245,32,12:REM 5340
530 DATA194,173,8,194,141,1,194,32,117:REM 4718
531 DATA197,160,0,177,253,145,251,200,192:REM 8445
532 DATA64,208,247,173,222,200,141,1,194:REM 6964
533 DATA76,96,193,147,76,79,65,68,32:REM 3576
534 DATA68,69,86,73,67,69,32,35,0:REM 2009
535 DATA160,0,185,184,203,200,32,210,255:REM 7865
536 DATA201,0,208,245,32,12,194,169,13:REM 4844
537 DATA32,210,255,32,101,201,152,162,80:REM 6136
538 DATA160,207,32,189,255,169,1,174,3:REM 5186
539 DATA194,160,1,32,186,255,169,0,32:REM 4574
540 DATA213,255,76,96,193,0,0,0,0:REM 2303
541 DATA0,255,111,0,255,0,255,0,255:REM 6198
550 DATA -1
```

(continued from previous page)

source sprite's number and the number of the sprite where the data must be placed.

SEARCH: This allows you to look through all the sprites in memory to find one you are looking for. In the top left corner the number is displayed and in the lower right corner, the sprite. Pressing any key will advance to the next sprite. Pressing Space allows for rapid searching. Pressing X returns you to Main Screen. Sprite 0 will have a blank for its sprite number.

GOTO: This allows you to jump to any sprite in the memory. When you return to main screen, the sprite you selected to Goto will be the current sprite.

Although the program is very lengthy and will take a long time to enter, you can be sure there are no errors as each line is checked after being entered. If you possess a machine code monitor — such as Supermon — you can save the program by using the command

S "EDITOR",C000,D000

Once saved, it can be quickly loaded directly into memory by

LOAD "EDITOR",8,1

If using tape, substitute 01 for 08 when saving and 1 for 8 when loading.

Happy editing. ■

Program 2.

```
50000 FL=200
50010 CO=1:AV=0:FORI=0TO8:READA:AV=AV+(CO*A):CO=CO+1:NEXT
50020 PRINT"LINE";FL;"...";AV
50030 PRINT"{C/DN}{C/DN}PRESS"
50040 GETA$:IFA$=""THEN50040
50060 FL=FL+1:GOTO50010
```

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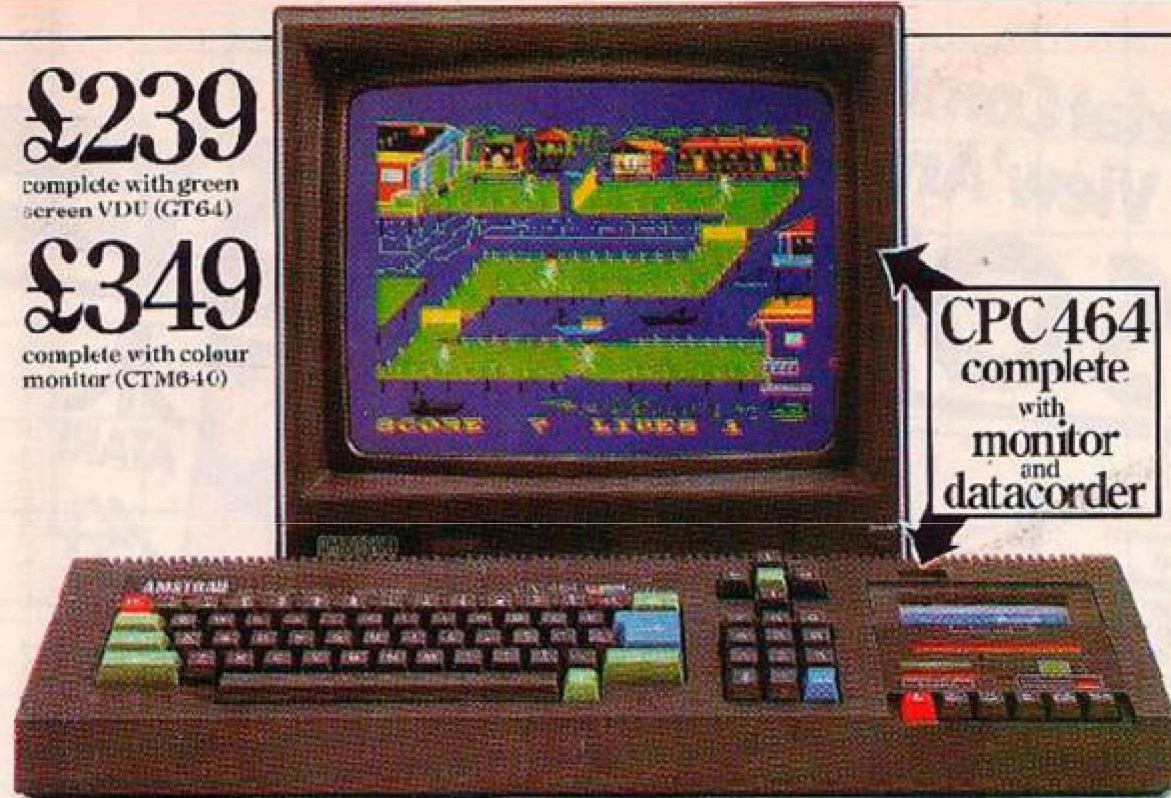
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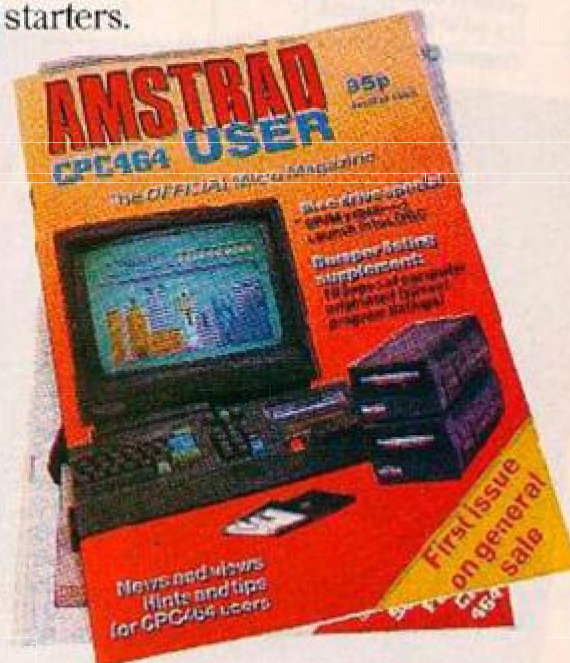
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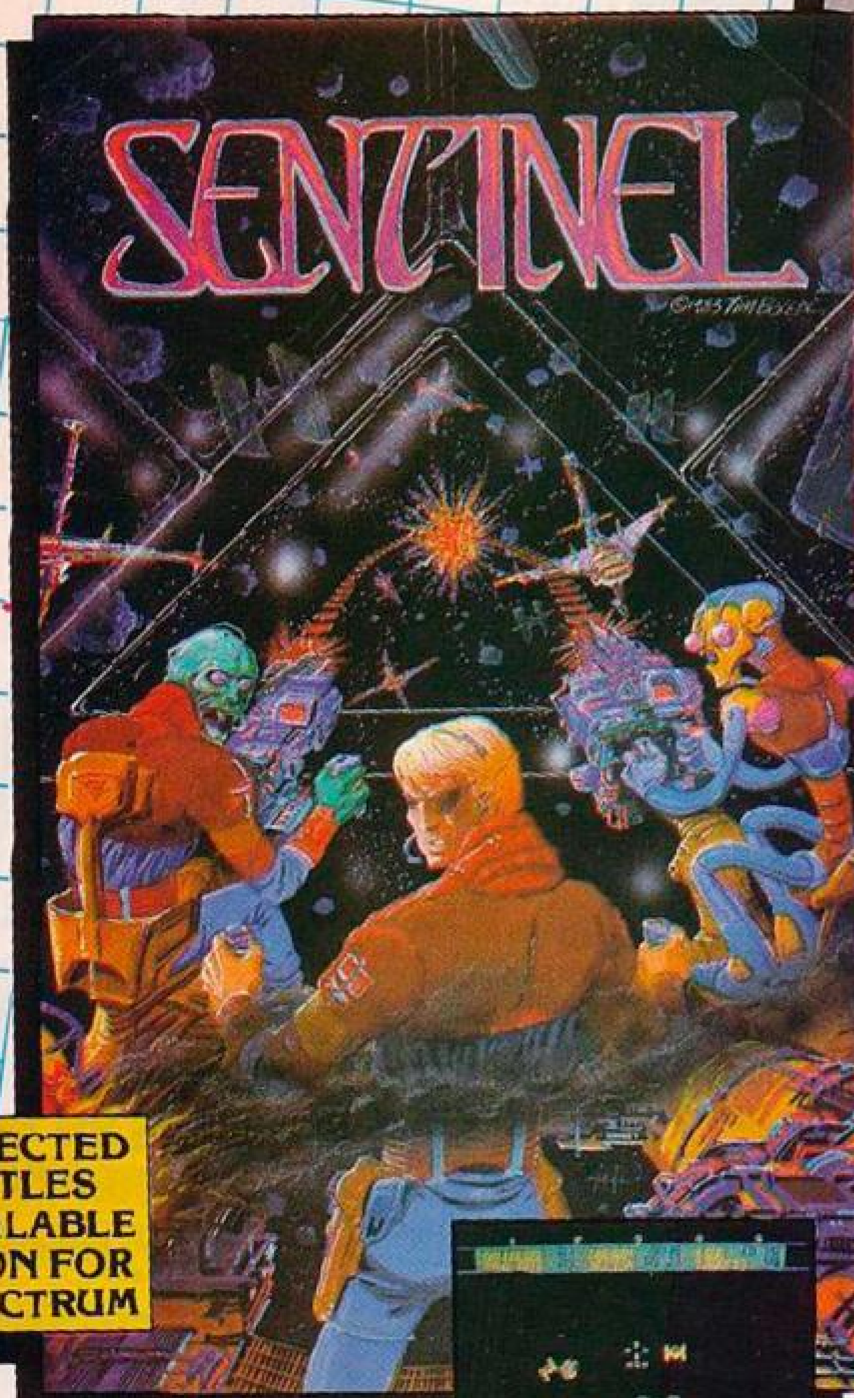
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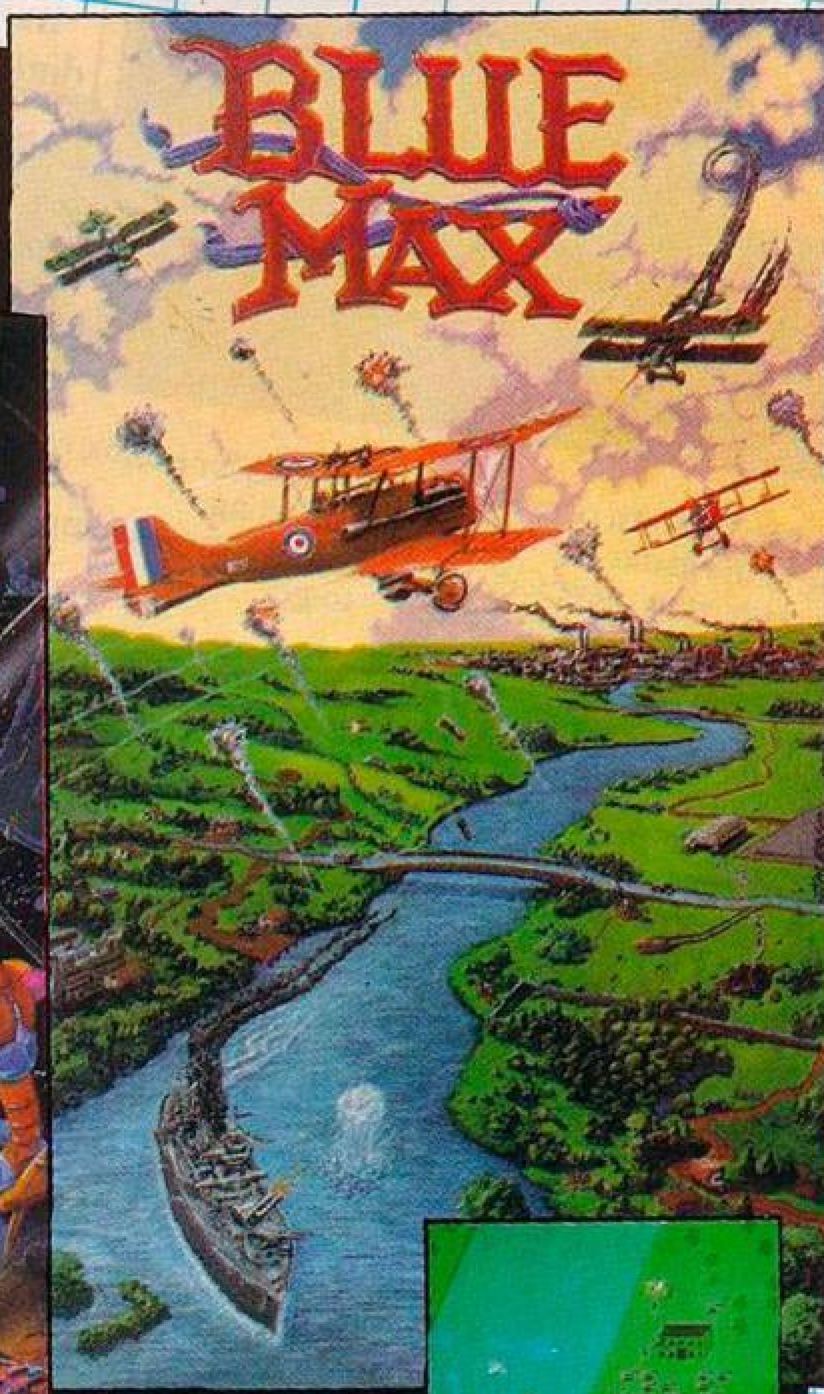
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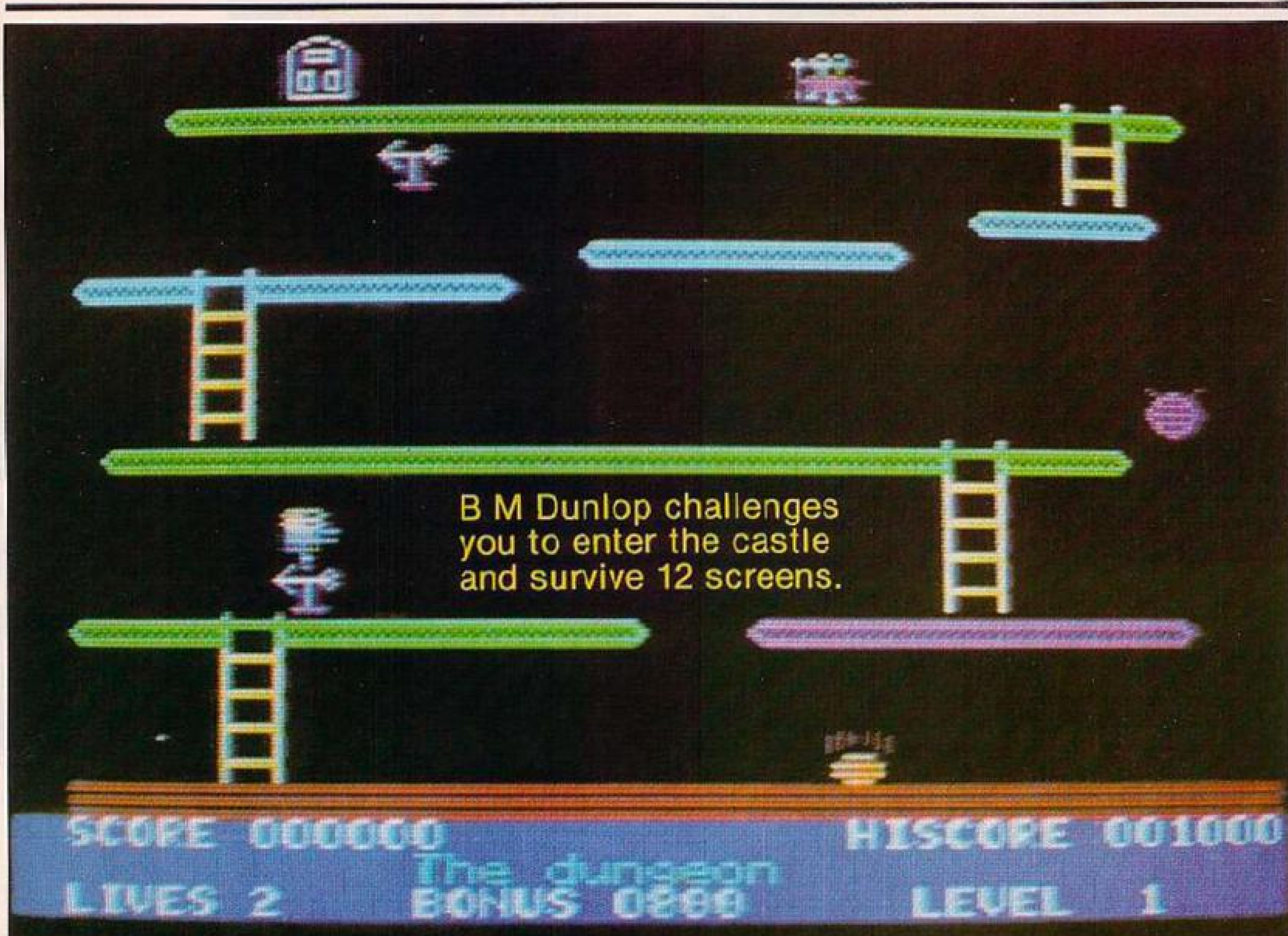
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B M Dunlop challenges you to enter the castle and survive 12 screens.

CREEP CASTLE

Creep Castle for Oric Atmos is a 12 screen platforms and ladders game with many different obstacles and hidden hazards to avoid. You have been thrown into the dungeon of the castle and you have to escape by reaching the door in the top left hand corner of each room. To help you escape you can move up, down, left, right and jump.

Five lives are given at the start of each game plus one extra should you complete all 12 screens. Once one screen has been completed you are awarded a number of points depending on how long you took. The Escape key can be used to end a game at any point if you are feeling suicidal.

A record of the top 10 scores is stored — minimum 1000 points — with the name of the scorers — maximum eight characters.

To enter the program, first type in listing 1 and save it on cassette with:

CSAVE"CASTLE",AUTO

Next, type

HIMEM7167

Listing 2.

```
10 INPUT"Start address ('S'to end)":A
$
20 IFA$="S"THENENDELSEC=0:A=VAL("#"+A
$)
30 PRINTMID$(HEX$(A),2);
35 INPUTB$
40 IFB$="S"THEN80
50 POKEA,VAL("#"+B$)
60 A=A+1:C=C+VAL("#"+B$)
70 GOTO30
80 PRINT"CHECK"C
90 PRINT
100 GOTO10
```

then New and enter the machine-code loader — listing 2.

After listing 2 has been entered, type Run. The code in listing 3 can now be entered block by block. To do this, input the start address, then the numbers with a press of the Return key between each; enter S once a block has been completed. To help detect typing errors, the machine-code loader calculates the total sum of all the bytes in one block which can be compared with the number given at the end of each block in the listing.

If the two numbers are not equal, then there is an error and the block will have to be re-entered. This method of error detecting although not infallible will uncover most mistakes.

After the whole of listing 3 is finished, firstly, well done, and secondly, position the cassette directly after listing 1 and enter the following:

POKE 46080,96:CSAVE"CASTLE2",A46080,E47104,AUTO

POKE 6912,96:CSAVE"CASTLE3",A6192,E30720,AUTO

The game is now complete and runs automatically on

CLOAD"CASTLE"

I see no reason why the game should not also work on the 48K Oric-1 but if you have an Atmos then you may wish to record the "error ignorer" program, printed in the manual, before listing 1.

Listing 1.

```
10 REM CREEPY CASTLE  By M. Dunlop
20 [illegible]
30 CLOAD"":CLOAD""
35 DOKE#[illegible]
#FF,#EF3
50 [illegible]
52 POKE#[illegible]
40 DIMN$(10),H(10)
50 FORI=1TO10
60 N$(I)="ORIC":H(I)=1000
70 NEXTI
80 [illegible]
90 PRINTSPC(6)"*** *** *** *** *** *
*"
100 PRINTSPC(6)"*   * * *   *   * * *
*"
110 PRINTSPC(6)"*   **  *** *** ***
*"
120 PRINTSPC(6)"*   * * *   *   *
*"
130 PRINTSPC(6)"*** * * *** *** *
*"
140 PRINT
150 PRINTSPC(5)"***  *  *** *** *   *
**"
160 PRINTSPC(6)"*   * * *    *  *   *
"
170 PRINTSPC(6)"*   * * ***  *  *   *
**"
180 PRINTSPC(6)"*   ***   *  *  *   *
"
190 PRINTSPC(6)"*** * * ***  *  *** *
**"
200 PRINT:PRINT" "CHR$(27)"JWritten b
y Myles Dunlop"
205 PRINT:PRINT
```

(Listing 1 continued on page 79)

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White Lightning is a complete games writing system comprising a high level, Forth based, multi-tasking games writing language and a powerful Sprite Generator Program. No knowledge of machine code is required and the final machine code game, which can run independently of White Lightning, can be marketed with no restrictions whatsoever. Also, with the standard tape version programs can even be written in a combination of Forth and BASIC.

Up to 255 sprites, each with its own user defined dimensions, can be scrolled, spun, reflected, enlarged or inverted with amazing speed and smoothness. Sprites can even stretch across several screens so scrolling landscapes are easy to achieve. Sinclair's own sound and graphics commands such as CIRCLE, DRAW and BEEP are fully supported.

MULTI-TASKING Without doubt White Lightning's most innovative feature is its use of interrupts to effectively run two programs at once. This means that while one program smoothly scrolls a landscape in the background, a second can animate the characters.

SPRITE DESIGN White Lightning comes complete with a separate 20k program for developing sprites used in the main system. Not only can you use this to design your own sprites from scratch, it also comes complete with 168 pre-defined characters covering games like Asteroids, Pac-Man, Assault Course, Defender, Space Invaders, City Bomber, Lunar Lander, Frogger, Centipede, Donkey Kong and many, many more. These characters are ready to use or can be enhanced. And sprites can be saved to tape between editing sessions before being finally added into the main program.

Machine Lightning is an advanced games writing utility which includes a full Macro Assembler, a Monitor/Disassembler, a Sprite Generator Program and the object code for the White Lightning graphics routines which have almost 100 documented entry points in 3k of code. The comprehensive manual explains how to use two copies of the object code to run machine code routines concurrently using the Z80 interrupts. Games written using Machine Lightning can be marketed with no restrictions.

THE MACRO ASSEMBLER This is arguably the most comprehensive assembler yet available for the Spectrum 48k. It supports Macros, conditional assembly and a full screen editor, and occupies 16k of memory.

THE MONITOR/DISASSEMBLER As well as all the usual monitor features, Spectre-Mac allows up to 10 breakpoints in ROM or RAM, has front panel display and single stepping.

THE SPRITE GENERATOR This is the same Sprite Designer/Editor supplied with White Lightning and can be used to design up to 255 sprites, up to a maximum of 12k.

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SU1

(listing 1 continued from page 77)

```
210 PRINT:PRINT" "CHR$(27)"fControls:
-
215 PRINT
220 PRINT" "CHR$(27)"CCursor left - l
eft"
230 PRINT" "CHR$(27)"ECursor right - r
ight"
240 PRINT" "CHR$(27)"BCursor down - d
own"
250 PRINT" "CHR$(27)"ACursor up - u
p"
260 PRINT" "CHR$(27)"FSpace bar - j
ump"
265 PRINT" "CHR$(27)"CESC - e
nd game"
270 GOSUB1000
280 CLS:INK3:POKE#26A,10:POKE48035,0
290 PRINT:E$=CHR$(27):PRINTCHR$(4)E$"
J"E$"J"E$"A     MASTERS OF THE CASTLE"
CHR$(4)
300 PRINT:PRINT
310 FORI=1TO10
315 PLOT2,3+I*2,MID$(STR$(I),2)
320 S$=LEFT$("000000",7-LEN(STR$(H%(I
))))+MID$(STR$(H%(I)),2)
325 PLOT5,3+I*2,CHR$(RND(1)*7+1)+S$
330 PLOT17,3+I*2,"....."
340 PLOT30,3+I*2,H$(I):NEXTI
350 GOSUB1000
360 GOTO80
1000 PLOT1,25,CHR$(12)+CHR$(7)+"Press
SPACE to start"
1005 KK$=KEY$
1010 FORI=1TO5000
1020 IFKEY$=" "THEN2000
1030 NEXTI
1040 RETURN
2000 GOSUB10000
2090 WAIT50
2100 A$=LEFT$("000000",7-LEN(STR$(H%(
1))))+MID$(STR$(H%(1)),2)
2110 FORI=1TO6
2120 POKE#4,8-I,ASC(MID$(A$,I,1))-48
2130 NEXTI
2140 CALL#0200
2150 GOSUB3000:PLAY0,0,0,0:WAIT100
2160 TEXT:INK7:POKE#26A,10:POKE48035,
0
2170 PLOT10,11,"YOUR GAME IS OVER"
2180 WAIT150
2190 CLS
2200 A$=""
2210 FORI=#400BTO#403STEP-1
2220 A$=A$+CHR$(PEEK(I)+48)
2230 NEXTI
2240 SC=VAL(A$)
2250 FORI=1TO10
2260 IFSC>H%(I)THEN2500
2270 NEXTI
2280 POP:GOTO280
2500 P=I:IFI=10THEN2540
2510 FORJ=9TOISTEP-1
2520 H%(J+1)=H%(J):H$(J+1)=H$(J)
2530 NEXTJ
2540 PLOT10,9,"Well done,"
2550 PLOT5,11,"you are now a master o
f"
2560 PLOT5,13,"the castle."
2570 PLOT8,15,"Please enter your name
"
2580 FORI=1TO17:PRINT:NEXT:PRINT">";:
N$=""
2590 GETX$:IFX$=CHR$(13)THEN2630
2595 IFASC(X$)<32THEN2600
2597 IFASC(X$)=127THENIFN$=""THEN2600
ELSEN$=LEFT$(N$,LEN(N$)-1):PRINTX$;:GO
TO2600
2610 N$=N$+X$:PRINTX$;
2620 IFLEN(N$)<9THEN2600
2630 H%(P)=SC:H$(P)=N$
2640 POP:GOTO280
3000 PLAY1,0,0,0
3010 FORI=10TO100STEP2
3020 SOUND1,I,10:SOUND2,200-I,10
3030 NEXTI
3040 RETURN
4000 IFPEEK(#FD00)<>2THEN4500
4010 DOKE#7801,#F590
4020 DOKE#7804,#EC33
4030 DOKE#7807,#F1C8
4040 POKE#7800,#4C:POKE#7803,#4C:POKE
#7806,#4C
4050 RETURN
4500 DOKE#7801,#F535
4510 DOKE#7804,#E5AA
4520 DOKE#7807,#EB1F
4530 GOTO4040
10000 REM ** PLAY TUNE **
10005 SOUND1,0,1
10010 PLAY1,0,0,0:RESTORE
10020 READ N,D:IFN=-1THENPLAY0,0,0,0:
RETURN
10030 MUSIC 1,3,N,12
10040 FORI=1TOD:NEXT
10050 GOTO10020
10060 DATA 1,50,5,50,8,50,1,50,5,50,8
,50
10070 DATA 8,50,6,50,2,50,1,70
10080 DATA -1,-1
```

Listing 3.

```
START=1C00
02 26 20 54 00 05 20 04 73 0E 67
65 6F 6E 20 20 20 20 20 23 00 41
74 74 81 63 00 20 6F 00 22 74 00
45 26 52 75 67 73 20 14 03 20 20
4A 75 6D 70 69 6E 67 20 49 65 60
65 20 20 20 14 14 01 20 20 20 54
48 65 20 73 6E 6E 66 66 20 20 20
20 20 14 14 02 27 20 48 6F 72 73
68 62 6C 65 20 6F 6F 6C 65 73 20
14 14 03 57 E1 6E 64 65 72 69 6E
67 20 57 69 6C 6C 79 20 20 14 14
02 20 54 68 65 26 67 72 65 65 6E
20 60 65 6E 20 26 20 14 14 0E 45
74 73 20 74 50 65 20 6D 75 6E 63
48 65 72 73 20 17 14 06 4E 6F 74
20 73 6F 20 68 61 72 64 77 61 72
65 20 20 14 14 01 54 68 E5 26 62
75 67 67 65 64 20 62 79 24 65 73
20 14 14 02 20 20 20 54 E8 65 20
74 6F 77 65 72 20 20 20 20 26 14
14 07 20 54 68 65 20 6C 61 73 74
20 65 78 69 74 20 20 20 14 20 20
20 23 20 20 20 20 20 20 20 20 20
20 23 20 20 20 20 20 20 20 20 20
20 22 20 20 20 20 20 20 20 20 20
20 22 20 20 20 20 20 20 20 20 20
20 22 20 20 20 20 20 20 20 20 20
20 22 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 23 20 20 20 20 20
20 20 20 20 20 23 20 20 20 20 20
20 20 20 20 20 23 20 20 20 20 20
20 20 20 20 20 23 20 20 20 20 20
20 20 20 20 20 22 20 20 20 20 20
20 20 20 20 20 22 20 20 20 20 20
20 20 20 20 20 22 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20
20 20 2E 20 20 20 20 20 20 20 20
20 20 2E 20 20 20 20 20 20 20 20
20 20 2E 20 20 20 20 20 20 20 20
20 20 2E 20 20 20 20 20 20 23 20
20 20 2E 20 20 20 22 20 20 23 20
20 20 2E 20 20 20 20 20 20 23 20
20 20 2E 20 20 20 20 20 20 01 06
01 40 3E 00 02 06 13 43 38 02 03
07 10 50 38 00 04 06 01 50 35 02
05 42 1C 70 30 02 FF
CHECK= 26572

START=1E20
06 01 FF 02 21 06 21 FF
CHECK= 591

START=1E30
02 14 02 05 04 E5 FF
CHECK= 292

START=1E40
06 01 FF
CHECK= 262

START=1E50
06 1C 02 2C FF
CHECK= 351

START=1EE0
12 04 02 05 00 02 02 01 02 02 02
05 06 04 04 03 04 04 04 1E E4 04
00 00 00 22 00 00 00 00 00 00 02
00 07 07 00 00 42 00 03 00 00 02
00 00 03 00 00 00 00 00 00 00 0E
00 00 55 66 03 00 00 0A 0A 0A 0F
00 00 0A 0A 00 00 0A 0A 00 00 CF
2A 31 03 00 00 00 00 00 00 0A 0F
00 30 03 00 00 00 00 75 15 03 0F
00 30 03 00 0C 00 00 00 00 00 0F
08 3C 03 00 FF
CHECK= 1705

START=2100
5A 34 01 00 00 00 00 00 00 00 02
00 30 03 00 07 07 00 00 60 00 03
00 30 03 00 09 09 00 00 00 00 02
00 30 03 00 00 38 64 03 00 00 0F
0A 30 03 00 00 0A 0A 00 00 CA 0F
00 30 0F 2A 01 00 00 00 00 02 0E
00 30 03 00 00 00 01 00 00 00 4E
10 02 02 00 00 22 07 0C 00 30 20
00 00 20 00 0C 20 02 FF
CHECK= 1494

START=2500
06 04 03 02 00 00 00 00 0E 00 03
00 00 00 0E 00 0E 00 00 0C 0C 01
00 00 0F 1E 0F 10 0F 10 00 00 0F
10 0F 10 0F 10 0A 0C 03 0F 10 03
00 0F 10 0E 00 0F 10 00 00 0F 13
00 00 10 04 03 0D 0E 00 00 0D 0E
00 00 0D 0E 00 00 0D 0E 00 00 79
34 01 07 07 00 00 20 00 00 00 07
07 00 00 00 00 00 E0 FF
CHECK= 1745

START=25EA
D5
CHECK= 213

START=2600
0A 04 33 00 00 00 00 13 14 00 20
00 00 30 00 11 12 00 00 DE 02 E4
11 11 30 00 00 00 00 00 17 12 E0
00 00 30 00 00 C6 04 03 15 16 15
16 15 16 15 16 15 15 15 16 15 15
15 16 3C 3C 03 00 00 00 00 17 17
00 00 20 03 00 00 18 18 00 00 48
16 03 20 04 20 00 17 17 00 00 00
00 00 00 19 18 00 00 FF
CHECK= 2305

START=2700
A2 3C 03 00 00 00 30 19 19 00 00
00 00 00 30 1A 1A 30 00 30 5E 02
00 00 00 30 1B 1B 30 03 00 00 00
00 1B 1B 00 00 30 1C 01 1C 1D 00
00 1C 1D 00 00 1C 1D 03 00 1C 1D
0E 00 12 3C 04 00 00 03 00 1E 1F
0E 00 00 00 00 00 1E 1F 00 00 4E
1E 03 20 20 00 00 20 20 00 00 20
2E 00 02 20 20 00 20 FF
CHECK= 1964

START=2800
60 30 02 20 00 00 00 13 10 00 00
00 00 00 20 1F 18 00 00 70 70 01
00 00 00 20 1F 18 00 00 00 00 00
00 1D 1D 20 00 48 00 02 00 00 30
00 1D 1D 20 00 00 00 00 00 1B 1B
00 00 A2 4C 0C 00 00 00 00 1B 1B
0E 00 00 0C 0C 00 1D 30 00 00 49
2A 01 00 0C 0C 00 21 21 00 00 30
00 00 00 21 21 00 00 FF
CHECK= 1938

START=2900
5A 30 24 00 00 00 00 1D 1E 00 00
00 00 00 00 1E 1B 00 00 CE 50 02
2. 21 00 00 21 21 00 00 21 21 00
00 21 21 00 00 60 00 03 0C 00 00
00 21 21 00 00 00 00 00 0C 21 21
00 00 AE 16 01 22 23 00 0C 22 23
00 00 22 23 00 00 22 23 0C 00 40
5C 03 24 25 24 25 24 25 24 25 24
25 24 25 24 25 24 25 FF
CHECK= 2703

START=29C8
00
CHECK= 0

START=29C8
D5
CHECK= 213

START=29CE
D5
CHECK= 213

START=29FC
D5
CHECK= 213

START=2A00
3C 30 03 00 00 00 00 18 15 00 00
E0 0E 00 00 1D 1D 00 30 7E 90 02
E0 0E 00 00 1D 1D 00 20 00 00 00
E0 1E 1B 00 00 AE 92 24 00 00 00
30 26 20 00 00 00 00 00 00 2F 20
30 00 30 45 03 00 00 00 00 26 26
30 00 00 00 00 00 26 26 00 00 BA
45 03 26 26 00 00 26 26 00 00 26
26 00 00 26 26 00 00 FF 46 02 26
26 00 00 26 26 00 00 26 26 00 00
26 23 00 00 FF
CHECK= 2330

START=2B00
2A 32 03 27 27 00 00 27 27 00 00
27 27 00 00 27 27 00 00 A0 50 01
00 00 00 00 29 29 00 00 00 00 00
00 29 29 00 00 34 50 01 00 00 00
00 29 29 00 00 03 00 00 00 29 29
00 00 24 2E 03 03 00 00 00 24 2A
00 00 00 00 00 03 2B 2B 00 00 DB
0C 02 2B 2B 00 02 00 00 00 00 2B
2B 00 22 22 00 00 00 FF
CHECK= 2213

START=2C00
2A 74 0C 2C 2C 00 00 2C 2C 03 00
2C 2C 00 00 2C 2C 00 00 40 71 04
2D 2D 00 00 2D 2D 00 00 2D 2D 00
00 2D 2D 00 00 00 00 00 2E 2E 00
00 00 00 00 00 2E 2E 00 00 00 00
00 00 32 24 02 00 00 00 00 18 18
00 00 00 00 00 E0 1E 1B 00 00 66
24 03 00 00 00 E0 1E 1D 00 00 00
00 00 00 1B 1B 00 00 FF
CHECK= 2347

START=2D00
BA 30 03 2F 30 00 00 2F 30 00 00
2F 30 00 00 2F 30 00 00 3C 64 03
30 2F 00 00 30 2F 00 00 30 2F 00
00 30 2F 00 00 C0 64 04 31 32 00
00 31 32 00 00 31 32 00 00 31 32
00 00 3C 42 01 00 00 00 00 1B 1B
00 00 03 00 00 00 1B 1B 00 00 48
13 00 03 00 00 00 32 31 00 00 00
00 30 03 32 31 00 00 FF
CHECK= 2276

START=2E00
0A 5C 05 00 00 00 00 00 2C 60 00
00 00 03 00 00 AC 00 00 18 6C 02
00 00 03 00 00 AC 00 00 00 00 00
00 00 0C 00 00 30 70 03 00 00 00
00 21 21 00 00 00 00 00 00 21 2.
00 30 3C 54 01 00 00 00 00 21 2.
00 30 00 00 00 30 21 21 00 00 48
14 23 33 34 00 30 33 34 00 00 33
34 30 00 33 34 30 03 FF FF
CHECK= 2170

START=2F00
1E 54 24 06 00 00 00 35 35 30 03
00 00 00 06 35 35 00 00 A2 34 03
00 00 00 06 35 35 00 00 00 00 00
00 35 35 00 00 02 35 03 00 30 00
00 35 36 00 00 00 00 00 00 36 36
00 00 66 29 01 00 00 00 00 1B 1B
00 00 00 00 00 00 1B 1B 00 00 48
14 04 00 00 00 00 75 75 00 00 00
00 00 00 35 35 00 40 FF
CHECK= 2183

START=310C
D5
CHECK= 213

START=3800
01 06 01 40 38 00 02 06 01 43 38
00 03 02 01 50 38 00 04 06 01 C0
38 00 05 02 01 70 38 00 FF
CHECK= 992

START=3840
06 01 FF 02 21 06 21 FF
CHECK= 591

START=3850
02 14 21 05 04 05 FF
CHECK= 292

START=3850
06 01 FF
CHECK= 262

START=3870
05 2C 02 1C FF
CHECK= 35.

START=3900
01 06 01 40 33 00 02 01 0. 60 39
02 03 04 01 80 33 00 04 01 01 A0
39 00 05 04 01 C0 39 00 FF
CHECK= 1217

START=3942
00 22 06 1C 02 3E FF
CHECK= 393

START=3960
E5 02 01 05 07 09 03 25 07 05 06
E9 FF
CHECK= 317

START=3960
06 0E 04 0C F2 0C 00 0C FF
CHECK= 315

START=3970
02 04 02 14 E0 1C 02 14 04 0F 02
10 04 0D FF
CHECK= 4E1

START=39C0
00 2C 04 2C FF
CHECK= 342

START=39CA
D5
CHECK= 213

START=39D0
F5 D5
CHECK= 458

START=39D0
D5
CHECK= 213

START=39DC
D5
CHECK= 213

START=39E2
D5
CHECK= 213

START=39E8
D5
CHECK= 213

START=39EE
D5
CHECK= 213

START=39F4
D5
CHECK= 213

START=3A00
01 06 01 40 3A 00 02 00 01 63 3A
00 03 06 01 00 3A 00 04 06 01 CA
3A 00 05 02 01 E0 3A 00 FF
CHECK= 1203

START=3A40
02 38 06 38 FF
CHECK= 375

START=3A60
04 14 00 14 FF
CHECK= 285

START=3A80
02 04 06 04 07 00 05 05 06 09 00
0A 00 0C 07 03 00 03 02 03 03 03
02 0C 04 0A 22 09 01 05 03 28 FF
25 03 28 FF
CHECK= 708

START=3AC0
02 2C 05 2C FF
CHECK= 351

START=3AE0
06 16 01 16 FF
CHECK= 307

START=3B00
01 02 01 40 3B 30 02 07 01 60 3B
00 03 02 01 00 3B 03 04 02 01 A0
3B 00 05 00 01 C0 3B 00 FF
CHECK= 1218

START=3B40
06 14 02 14 FF
CHECK= 303

START=3B60
06 0F F2 0F FF
CHECK= 283

START=3B80
06 07 E2 0C 04 00 00 05 02 26 05
05 04 E0 00 00 FF
CHECK= 341

START=3BA0
06 1D 02 1D FF
CHECK= 321

START=3BC0
04 06 00 06 02 0A 04 02 00 02 06
0A FF
CHECK= 307

START=3C00
01 02 01 40 3C 00 02 02 01 60 3C
00 03 02 0. 60 3C 00 04 02 01 F0
3C 00 05 02 01 C0 3C 00 FF
CHECK= 1225

START=3C40
06 14 02 14 FF
CHECK= 303

START=3C60
06 1E 32 1E FF
CHECK= 323

START=3C80
06 0F 22 0F FF
CHECK= 293

START=3CA0
0E 06 22 06 FF
CHECK= 279

START=3CC0
06 3C 02 3C FF
CHECK= 383

START=3D00
01 02 01 40 3D 00 02 06 01 60 3D
00 03 02 F1 80 3D 00 04 06 01 40
3D 00 05 64 01 C0 3D 00 FF
CHECK= 1240

START=3D40
06 03 02 05 FF
CHECK= 281

START=3D60
07 0A 06 0A FF 05 06 E5 02 05 04
05 FF
CHECK= 570

START=3D80
00 13 02 13 FF
CHECK= 30.

START=3DA0
02 1E 06 1E FF 09 00 1E 02 1E 00
0A FF
CHECK= 604

START=3DC0
02 03 06 03 07 04 05 04 06 04 0E
0A 02 10 30 0E 04 0D 06 10 04 0A
02 04 01 34 03 04 FF
CHECK= 411

START=3E00
E1 02 01 00 3E 00 02 32 01 80 3E
E0 03 06 01 A0 3E 00 24 02 01 C0
FF 00 05 02 01 F0 3E 20 FF 02 01
E0 3E 00 FF
CHECK= 1543
```

(listing 3 continued on page 80)

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START=3E40
02 5C 08 5C FF
CHECK= 575

START=3E60
06 0E 02 0E FF
CHECK= 291

START=3E80
08 18 03 18 FF
CHECK= 305

START=3EA0
02 18 08 18 FF
CHECK= 317

START=3EC0
08 18 02 18 FF
CHECK= 295

START=3EE0
08 04 02 01 00 04 04 04 FF
CHECK= 295

START=3F00
01 02 01 40 3F 00 02 05 01 80 3F
00 03 02 01 A0 3F 00 04 02 01 C0
3F 00 05 08 01 E0 3F 00 FF
CHECK= 1370

START=3F40
0E 0A 02 0A 00 35 02 10 14 03 02
1A 05 0A 08 03 08 10 04 05 FF
CHECK= 375

START=3F60
0E 2A 02 2A 04 10 05 10 14 10 05
3F 02 10 00 10 22 10 00 10 FF
CHECK= 515

START=3F80
02 2E 00 2E FF
CHECK= 355

START=3FA0
08 2E 02 2E FF
CHECK= 355

START=3FC0
05 24 02 24 FF
CHECK= 335

START=3FE0
04 2F A0 01 FF
CHECK= 203

START=4000
01 00 01 40 40 80 02 00 01 80 40
00 03 04 0 60 40 00 05 01 A0
40 00 05 01 01 C0 40 00 FF
CHECK= 1203

START=4040
02 00 00 00 00 12 02 1C 00 1C 04
12 FF
CHECK= 375

START=4060
0C 00 05 00 00 08 04 00 FF
CHECK= 305

START=4080
08 18 04 18 FF
CHECK= 307

START=40A0
02 0D 06 0C FF
CHECK= 289

START=40C0
02 06 06 0C FF
CHECK= 275

START=4100
01 00 01 40 41 80 02 02 01 80 41
03 03 05 01 E0 41 00 04 C2 01 C0
41 00 05 02 01 E0 41 00 FF
CHECK= 1505

START=4140
02 0C 05 0C 08 07 08 14 01 07 06
0C 02 0C 00 07 02 14 04 07 FF
CHECK= 483

START=4160
01 0C 02 0C 04 07 02 14 01 07 02
0C 06 0C 04 07 05 14 00 07 FF
CHECK= 403

START=4180
07 03 06 03 00 04 06 0C 01 04 06
03 00 04 05 0C 14 04 05 03 02 03
00 04 02 0C 04 14 02 03 00 04 02
0C 04 04 FF
CHECK= 409

START=41C0
01 70 02 70 FF
CHECK= 503

START=41E0
04 30 03 30 FF
CHECK= 327

START=4200
01 06 11 40 42 00 02 07 01 A0 12
00 03 02 01 00 42 00 04 02 01 A0
42 00 05 02 01 C0 42 00 FF
CHECK= 1259

START=4240
06 1C 05 1C FF
CHECK= 319

START=4260
0C 20 02 20 FF
CHECK= 353

START=4280
0C 0E 02 0E FF
CHECK= 291

START=42A0
0C 18 02 18 FF
CHECK= 311

START=42C0
0C 08 12 08 04 03 06 14 01 10 04
0E 20 00 05 10 02 14 00 04 FF
CHECK= 423

START=4300
01 02 01 40 43 00 02 07 01 50 43
00 03 05 01 12 43 00 04 02 01 A0
43 00 05 02 41 C0 43 00 FF
CHECK= 1284

START=4340
05 3C 02 3C FF
CHECK= 351

START=4360
06 10 02 10 FF
CHECK= 295

START=4380
02 10 06 10 FF
CHECK= 295

START=43A0
06 24 02 24 FF
CHECK= 335

START=43C0
08 10 02 10 FF
CHECK= 311

START=43E0
FE 09 02 20 01 20 01 FE 09 03 20
01 27 01 FE 06 04 06 01 20 01 21
08 FE 19 04 05 01 21 01 24 01 25
01 25 01 FE 38 05 03 01 24 01 25
01 FE 13 05 05 01 24 01 25 01 FE
18 07 03 01 24 01 25 01 FE 0A 00
05 01 20 01 21 08 24 01 25 01 23
01 FE 21 09 05 01 24 01 25 01 FE
21 0A 05 01 24 01 25 01 FE 21 00
05 01 24 01 24 01 FE 21 0C 05 01
24 01 25 01 FE 21 0D 05 01 24 01
25 01 FE 1A 0E 05 01 20 01 24 01
25 01 21 06 25 01 FE 10 0F 03 01
24 01 25 01 FE 10 10 03 01 24 01
25 01 FE 10 11 03 01 24 01 25 01
FE 10 12 03 01 24 01 25 01 FE 10
13 03 01 24 01 25 01 FE 02 04 06
01 20 01 21 0E 24 01 25 01 23 01
FE 21 15 05 01 24 01 25 01 FE 21
16 05 01 24 01 25 01 FE 21 17 05
01 24 01 25 01 FE 21 18 01 01 20
20 FE 04 07 07 01 45 01 73 01 63
01 E1 01 70 01 65 01 21 03 FF 01
2C 11 FF 03 0A 02 01 72 01 6E 01
01 01 53 01 69 01 20 01 74 01 68
01 65 01 20 01 64 01 6F 02 72 01
20 41 74 01 69 01 65 01 6E 41 FE
03 08 07 01 79 01 6F 01 75 01 20
01 63 01 61 01 6E 01 20 01 74 01
72 01 79 01 20 01 61 01 67 01 61
01 69 01 6E 01 FF 01 0E 01 1E 03
00 07 01 74 01 68 01 73 01 EF 01
75 01 67 01 61 01 20 01 74 01 68
01 69 01 20 01 04 01 6F 02 72 01
20 01 74 01 53 01 55 01 6E 01 FE
03 0F 07 01 04 01 51 01 70 01 65
01 20 01 01 FE 09 32 20 01 20 01
FE 09 02 20 01 27 01 FE 08 04 01
01 20 01 21 08 24 01 25 01 23 01
FE 08 05 02 01 24 01 25 01 FE 08
06 02 01 24 01 25 01 FE 04 07 03
01 20 01 24 01 25 01 21 07 23 01
FE 05 08 02 01 24 01 25 01 FE 0A
09 02 01 24 01 25 01 FE 04 0A 03
01 20 01 21 02 23 01 FE 10 0A 01
01 20 01 24 01 25 01 23 01 FE 11
08 02 01 24 01 25 01 FE 11 0C 02
01 24 01 25 01 FE 11 03 02 01 24
01 25 01 FE 1 0E 02 01 24 01 25
01 FE 02 0F 01 01 20 01 24 01 25
01 21 02 FE 10 0F 03 01 21 04 23
01 FE 03 10 02 01 24 01 25 01 FE
03 11 03 01 24 01 25 01 FE 03 12
02 08 24 01 25 01 FE 03 13 02 01
24 01 25 01 FE 03 14 02 01 24 01
25 01 FE 01 15 01 01 20 01 21 1E
24 01 25 01 23 01 FE 20 16 02 01
24 01 25 01 FE 20 17 02 01 20 01
25 01 FE 01 18 09 01 2A 20 FF
CHECK= 22839

START=5000
FE 01 02 20 01 23 01 FE 09 03 20
01 27 01 FE 01 04 05 01 20 01 21
14 24 01 25 01 23 01 FE 10 06 01
01 20 01 25 01 FE 10 05 01 01 24
01 25 01 FE 10 07 01 01 24 01 25
01 FE 10 08 01 01 24 01 25 01 FE
03 08 03 01 20 01 24 01 25 01 21
01 20 01 FE 04 09 01 01 24 01 25
01 FE 04 0A 01 01 24 01 25 01 FE
04 00 01 01 24 01 25 01 FE 02 0C
08 01 20 01 21 05 23 01 FE 0F 0C
03 01 20 01 21 02 23 01 FE 13 0C
05 01 20 01 21 07 23 01 FE 05 0E
03 01 20 01 21 02 23 01 FE 14 0E
05 01 20 01 21 02 23 01 FE 17 0E
03 01 20 01 21 03 24 01 25 01 23
01 FE 22 0F 01 01 24 01 25 01 FE
22 12 01 01 24 01 25 01 FE 22 11
01 01 24 01 25 01 FE 05 12 05 01
20 01 24 01 20 01 21 04 23 01 FE
11 12 03 01 20 01 21 04 23 01 FE
1C 12 08 01 20 01 21 05 24 01 25
01 21 01 23 01 FE 08 13 01 01 24
01 21 01 FE 06 14 01 01 24 01 25
01 FE 06 15 01 01 24 01 25 01 FE
06 15 01 01 24 01 25 01 FE 05 17
01 01 24 01 25 01 FE 01 18 02 01
2A 25 FF
CHECK= 13599

START=51F0
FE 01 02 20 01 25 01 FE 09 03 20
01 27 01 FE 07 04 07 01 20 01 21
01 21 01 FE 18 04 03 01 20 01 21
01 21 01 FE 21 05 01 01 20 01 21
02 21 01 FE 16 07 02 01 20 01 21
02 21 01 FE 21 09 01 01 20 01 24
01 21 01 23 01 FE 22 0A 03 01 24
01 31 01 FE 23 08 03 01 24 01 25
01 FE 22 0C 03 01 24 01 25 01 FE
22 01 03 01 24 01 25 01 FE 22 0E
03 01 24 01 25 01 FE 22 0F 03 01
24 01 25 01 FE 20 10 02 01 21 01
21 01 23 01 FE 02 04 01 01 21 01
24 01 25 01 21 0C 24 01 25 01 23
01 FE 03 00 02 01 24 01 25 01 FE
03 0C 03 01 24 01 25 01 FE 03 00
03 01 24 01 25 01 FE 03 0E 03 01
24 01 25 01 FE 03 0F 03 01 21 01
25 01 FE 03 10 03 01 24 01 25 01
FE 11 03 03 01 24 01 25 01 FE 11
0C 01 01 24 01 25 01 FE 11 0D 03
01 21 01 25 01 FE 11 0E 03 01 24
01 21 01 FE 11 0F 03 01 24 01 25
01 FE 11 10 0C 01 24 01 25 01 FE
01 11 01 01 20 01 21 03 24 01 25
01 23 01 FE 0F 1 02 01 20 01 21
01 23 01 FE 05 2 03 01 24 01 25
01 FE 05 12 03 01 24 01 25 01 FE
05 14 03 01 24 01 25 01 FE 05 15
01 01 24 01 25 01 FE 05 16 03 01
24 01 25 01 FE 05 17 03 01 24 01
21 01 FE 01 18 09 01 2A 25 FF
CHECK= 13935

START=5300
FE 09 02 20 01 25 01 FE 01 03 20
01 27 01 FE 01 14 01 01 20 01 21
01 23 01 FE 14 14 01 01 20 01 21
01 24 01 25 01 21 01 23 01 FE 15
05 05 01 24 01 25 01 FE 16 00 05
01 24 01 25 01 FE 04 07 01 01 20
01 21 34 20 04 21 08 23 01 FE 1C
04 02 01 20 01 24 01 25 01 23 01
FE 22 0C 01 01 20 01 21 01 23 01
FE 10 20 05 01 24 01 25 01 FE 10
0C 05 01 24 01 25 01 FE 10 0D 05
01 24 01 25 01 FE 10 0E 01 01 24
01 25 01 FE 10 11 02 01 20 01 21
02 23 01 FE 10 13 02 01 20 01 21
02 23 01 FE 0E 12 02 01 20 01 21
02 23 01 FE 05 14 02 01 20 01 21
01 24 01 25 01 21 01 23 01 FE 17
15 05 01 24 01 25 01 FE 07 10 15
01 24 01 25 01 FE 07 17 01 01 24
01 25 01 FE 01 18 03 01 2A 25 FF
CHECK= 8598

START=5510
FE 03 02 20 01 25 01 FE 01 03 20
01 27 01 FE 07 04 05 01 20 01 21
01 23 01 FE 12 06 08 01 20 01 21
01 23 01 FE 1A 07 06 01 20 01 24
01 25 01 23 01 FE 10 00 05 01 24
01 25 01 FE 18 00 05 01 24 01 25
01 FE 03 0A 08 01 20 01 24 01 25
01 21 07 23 01 FE 04 08 05 01 24
01 25 01 FE 04 0C 05 01 24 01 25
01 FE 04 0D 05 01 24 01 25 01 FE
04 0E 05 01 24 01 25 01 FE 04 0F
0C 01 24 01 25 01 FE 24 16 05 01
24 01 25 01 FE 04 11 05 01 24 01
25 01 FE 03 12 05 01 20 01 21 03
23 01 FE 1F 12 05 01 20 01 21 01
24 01 25 01 21 05 23 01 FE 21 13
0C 01 24 01 25 01 FE 21 14 05 01
24 01 25 01 FE 21 15 05 01 24 01
25 01 FE 21 10 05 01 24 01 25 01
FE 31 17 08 01 24 01 25 01 FE 01
18 03 01 2A 26 FF
CHECK= 9128

START=58A0
FE 00 02 20 01 23 01 FE 01 03 20
01 27 01 FE 00 01 03 01 20 01 21
03 24 01 25 01 FE 0A 05 01 01 24
01 25 01 FE 0A 05 00 01 24 01 25
01 FE 0A 07 00 01 24 01 25 01 FE
0A 00 09 01 24 01 25 01 FE 01 09
03 01 20 01 24 01 25 01 21 08 23
01 FE 02 0A 00 01 24 01 25 01 FE
02 08 00 01 24 01 25 01 FE 02 0C
00 01 24 01 25 01 FE 01 0C 02 01
20 01 21 02 23 01 FE 09 0C 02 01
20 01 21 02 23 01 FE 16 0C 00 01
24 01 25 01 FE 11 04 02 01 20 01
21 03 23 01 FE 10 00 00 01 24 01
25 01 FE 10 07 0A 01 24 01 25 01
FE 10 10 00 01 24 01 25 01 FE 10
00 0A 11 24 01 25 01 FE 10 0A 05
01 24 01 25 01 FE 21 03 02 01 20
01 24 01 25 01 21 01 FE 22 04 05
01 24 01 23 01 FE 22 05 00 01 24
01 25 01 FE 22 06 00 01 24 01 25
01 FE 22 07 06 0 24 01 25 01 FE
20 00 02 01 20 0 21 03 23 01 FE
24 0C 02 01 20 0 23 01 FE 10 0E
02 01 20 01 24 0 25 01 21 05 23
01 FE 0E 0F 00 0 24 01 25 01 FE
1E 12 05 01 24 0 25 01 FE 1E 11
06 01 24 01 25 0 FE 1C 12 02 01
21 00 23 01 FE 1E 11 02 01 20 01
21 04 FE 09 13 02 01 20 01 24 01
25 01 23 01 FE 0A 14 05 01 24 01
25 01 FE 0A 15 08 01 24 01 25 01
FE 0A 10 05 01 24 01 25 01 FE 1A
17 05 01 24 01 25 01 FE 01 18 25
01 2A 25 FF 01 2A 26 FF
CHECK= 15422

START=5C30
FE 0A 02 20 01 25 01 FE 03 03 20
01 27 01 FE 24 04 05 01 20 01 21
0C 23 01 FE 22 08 02 01 24 01 25
01 FE 22 07 02 0 24 01 25 01 FE
22 08 02 01 24 0 25 01 FE 21 03
03 01 20 01 21 02 23 01 FE 04 0B
05 01 20 01 24 0 25 01 21 11 23
01 FE 05 0A 02 0 24 11 25 01 FE
05 28 02 01 24 0 25 11 FE 03 0C
05 01 20 01 21 04 23 11 FE 04 10
02 01 20 01 21 03 23 11 FE 1C 0F
05 01 20 01 21 07 24 01 25 01 21
01 23 01 FE 20 10 02 01 24 01 25
01 FE 20 11 02 01 24 01 25 01 FE
20 12 00 01 24 01 25 01 FE 20 13
02 01 24 01 25 01 FE 10 14 02 01
24 01 25 01 FE 11 15 05 01 20 01
21 05 23 01 FE 01 18 03 01 2A 2E
FF
CHECK= 8861

START=5DC0
FE 09 01 20 01 25 01 FE 09 02 25
01 27 01 FE 01 02 06 01 20 01 21
09 23 01 FE 14 04 00 01 23 01 FE
12 03 05 01 20 01 21 02 24 01 25
01 23 01 FE 15 04 01 01 24 01 25
01 FE 15 05 01 01 24 01 25 01 FE
15 20 01 01 24 01 25 01 FE 01 07
00 01 23 01 24 01 25 01 21 12 23
01 FE 02 08 01 01 24 01 25 01 FE
02 09 01 01 24 01 25 01 FE 01 01
08 01 23 01 21 02 23 01 FE 07 01
06 01 20 01 21 01 24 01 25 01 21
05 24 01 25 11 23 01 FE 09 0C 01
01 24 01 25 01 FE 09 00 01 01 21
01 25 01 FE 10 0E 01 01 24 01 21
01 FE 09 0F 01 01 24 01 25 01 FE
10 0C 01 01 24 01 25 01 FE 10 01
01 01 24 01 25 01 FE 10 0E 01 01
24 01 25 01 FE 10 0F 01 01 24 01
25 01 FE 0E 10 00 01 20 01 21 00
23 01 FE 20 0C 00 01 21 04 24 01
25 01 2 01 FF 24 00 01 01 24 01
25 01 FE 24 0C 01 01 24 01 25 01
FE 24 01 01 01 24 01 25 01 FE 21
10 01 01 24 01 25 01 FE 19 1 06
01 28 01 21 04 24 01 25 01 2 07
FE 11 12 01 01 24 01 25 01 FE 1E
13 01 01 24 01 25 01 FE 1C 14 02
01 21 00 FE 10 15 02 01 21 03 FE
10 14 02 01 21 03 FE 01 18 01 01
2A 2E FF 01 2A 28 FF 25 FF
CHECK= 13050

START=5850
7E 0C 00 10 01 28 01 FE 03 03 25
01 21 01 FE 04 04 01 01 28 01 21
10 24 01 25 01 21 01 23 01 FE 15
05 05 01 24 01 25 01 FE 15 08 02
01 24 01 25 01 FE 15 07 02 01 24
01 24 01 FE 15 08 02 01 24 01 25
01 FE 02 09 01 01 20 01 21 01 24
01 25 01 11 15 23 01 FE 04 0F 02
01 24 01 25 01 FE 04 08 02 01 24
01 25 01 FE 03 0C 01 01 28 01 21
05 25 01 FE 00 0D 0 01 28 01 21
05 24 01 25 01 21 0 23 01 FE 13
0E 02 01 24 01 25 0 FE 13 0F 02
01 24 01 25 01 FE 13 10 02 01 24
01 25 01 FE 0D 11 0 01 28 01 21
01 28 03 11 07 23 0 FE 10 12 01
01 28 01 21 06 24 0 25 01 21 01
FE 24 13 02 01 24 0 25 01 FE 24
14 02 01 24 01 25 0 FE 24 15 02
01 24 01 25 01 FE 0 14 05 01 28
01 21 07 23 01 28 03 20 01 21 0F
23 01 FE 22 18 01 0 28 01 21 03
23 01 FE 01 18 02 0 2A 26 FF
CHECK= 9570

START=5CE0
FE 09 02 20 01 29 01 FE 09 03 20
01 27 01 FE 04 24 05 01 22 01 21
02 23 01 20 01 05 01 22 01 24 01
25 01 21 0 23 01 FE 10 05 06 01
24 01 25 01 FE 10 06 08 01 24 01
25 01 FE 10 07 06 01 24 01 25 01
FE 10 08 08 01 24 01 25 01 FE 0E
00 00 01 20 01 21 02 23 01 FE 10
0A 03 01 22 01 21 07 23 01 FE 1E
0B 03 01 22 01 21 04 24 01 25 01
23 01 FE 23 0C 06 01 24 01 25 01
FE 23 00 06 01 24 01 25 01 FE 23
0E 05 01 24 01 25 01 FE 23 0F 06
01 24 01 25 01 FE 1F 10 03 01 22
01 21 05 23 01 FE 10 0F 03 01 22
01 21 02 23 01 FE 05 0E 03 01 22
01 21 02 24 01 25 01 21 00 23 01
FE 05 0F 00 01 24 01 25 01 FE 05
0 08 01 24 01 25 01 FE 05 11 06
01 24 01 25 01 FE 0E 12 06 01 24
01 25 01 F1 01 13 0C 01 22 01 21
0A 24 01 25 01 21 01 23 01 FE 0F
14 06 01 24 01 25 01 FE 0C 15 06
01 24 01 22 01 FE 0C 16 06 01 24
01 25 01 F1 0C 17 06 01 24 01 25
01 FE 21 11 02 01 2F 26 FF
CHECK= 10970

START=5E70
FE 05 02 21 01 29 01 FE 09 03 20
01 27 01 F1 04 04 02 01 22 01 21
10 24 01 23 01 21 01 23 01 FE 20
05 05 01 24 01 25 01 FE 10 00 03
01 24 01 21 01 FE 1E 07 08 01 22
01 21 04 21 01 FE 11 00 00 01 22
01 21 00 21 01 FE 01 05 00 01 22
01 21 03 24 01 25 01 21 07 23 01
FE 05 0A 00 01 24 01 25 01 FE 05
0B 03 01 24 01 25 01 FE 05 0C 03
01 24 01 23 01 FE 05 00 03 01 24
01 25 01 F1 02 0E 02 01 22 01 21
19 24 01 21 01 21 03 23 01 FE 1C
0F 03 01 24 01 25 01 FE 1C 10 03
01 24 01 21 01 FE 1C 11 03 01 24
01 25 01 FE 1C 12 03 01 24 01 25
01 FE 01 13 02 01 22 01 31 04 24
01 25 01 21 0A 23 01 20 02 05 01
12 01 21 0C 23 01 FE 00 4 03 01
24 01 25 01 FE 00 15 03 01 24 01
25 01 FE 00 16 03 01 24 01 25 01
FE 00 17 01 01 24 01 23 01 FE 01
18 01 01 2A 20 FF
CHECK= 9379

START=[illegible]
F3 00 04 AE 01 04 AC 02 04 85 4E
49 09 4B 84 48 13 FA 84 15 42 A0
F0 24 85 41 C8 45 F0 10 18 A5 42
E9 24 85 41 A5 43 E9 00 15 43 4C
18 00 A9 40 85 15 A9 A9 15 43 C8
F9 20 85 41 08 00 10 18 F5 44 69
30 85 44 A5 45 39 20 85 45 4C 38
C0 0A A0 00 30 19 08 90 04 C8 4C
51 08 18 61 00 15 47 84 48 04 4A
45 44 85 44 A5 45 85 41 F9 0C 85
40 A2 02 A5 47 30 10 A4 49 B1 42
A4 48 09 44 91 40 E6 48 E5 49 A4
40 B1 42 A4 48 15 4B 91 40 E5 49
4C C8 50 A4 49 91 42 20 F9 08 E8
20 D0 09 A4 48 35 48 91 48 4C AC
5B A4 48 1 48 11 48 E5 48 A4 49
B1 42 E5 49 20 24 01 A4 48 E9 48
91 42 CA D0 D2 A5 4A 85 48 18 A5
48 A9 20 85 4A 45 41 A4 00 85 41
C5 48 D0 86 C8 48 A2 0C A4 49 B1
42 E5 49 A4 48 91 44 10 A5 44 59
28 85 44 A5 45 69 00 85 45 CA D0
E5 68 AA 88 A8 68 60 A4 47 C0 81
F0 11 C0 01 F0 0F C0 03 F0 EE C8
04 F0 0E C0 05 F0 0F C0 4A 80 4A
49 60 4A 4A 4A 60 4A 4A 4A 4A 60
4B 4A 4A 4A 4A 60 48 A9 00 38 E5
47 A8 C0 C0 01 F0 11 C0 02 F0 11
C0 03 F0 1. C0 04 F0 14 C0 05 F0
17 60 0A 2A 3F 60 0A 0A 2A 3F 60
0A 0A 0A 2A 3F 60 0A 0A 0A 0A 2A
3F 60 0A 0F 0A 0A 0A 2A 3F 60 A0
23 24 AE 01 04 AC 02 04 85 45 48
31 48 0A 41 20 E5 61 A9 0E 85 48
A5 4A 85 4E A2 04 A4 48 B1 42 E6
43 A4 49 91 42 E6 49 CA D0 F1 18
A1 40 69 20 85 40 A5 41 69 00 85
41 C0 48 D0 DA 68 AA 68 A8 68 60
A3 00 04 AE 01 04 AC 02 04 85 46
43 98 4A 0F 48 20 E5 61 A0 0C 85
41 A5 4A 8C 48 A2 04 A4 49 B1 42
E1 49 A4 48 91 42 E6 48 C6 D0 F1
17 A5 40 69 20 85 40 A5 41 69 00
85 41 C6 4E D0 DA 68 AA 68 A8 60
63 A9 00 85 40 A9 A0 85 41 C0 00
F4 10 18 AC 40 69 20 85 40 A5 41
61 00 85 41 4C EE 61 A0 00 8A 30
E1 05 90 04 C8 4C 04 A2 00 84 4A
A0 FC 04 85 42 A0 FD 04 85 43 C0
41 30 10 A5 42 18 69 30 85 42 A5
43 69 00 85 43 4C 1A 62 A0 00 85
49 60 AE 00 04 AC 01 04 40 8A 48
98 48 08 53 80 54 A0 FE 04 85 4D
A0 FF 04 85 4E E8 53 C6 53 F0 10
18 A5 4D 69 13 85 4D A5 4E 69 00
85 4E 4C 4E 62 84 52 A4 00 B1 4D
85 4F C8 B1 4D 85 50 A6 4F 84 50
A5 54 20 A0 51 A0 02 B1 4D 85 51
A5 52 8A A0 00 85 53 18 65 4F 85
4F C8 89 85 53 18 65 50 85 50 20
D4 62 C8 51 C0 E4 A0 08 A5 4F 91
4D C8 A5 50 91 4D A5 54 A8 4F A4
50 30 08 61 E5 4C A5 4C 4A 90 09
A4 52 89 F8 62 A0 4C C1 62 A4 52
89 FD 62 A8 C8 B1 4D A4 4F A4 50
20 E9 60 68 A4 08 A8 68 60 A5 4F
C9 C8 90 0F C9 E4 90 14 A5 50 C9
FF F0 0F C9 8C 90 18 A9 A9 E3 85
4F C8 A9 00 81 4F 58 AE 0B 15 50
A0 F9 00 65 54 A0 A3 0E 07 C0 08
0D 0F 11 00 FF 01 FF 01 00 11 01
00 E1 FF 01 FF 00 FF FF AE 11 04
AC 02 04 8A 48 98 48 84 59 AD FE
04 85 4D A0 FF 04 85 4E E8 CA F0
10 10 A5 4D 63 13 85 4E A5 4E 69
00 85 4E 4C 2C 63 A0 00 B1 4D 85
55 C8 81 4D 85 56 14 55 C8 A0 FE
04 85 4D A0 FF 04 85 4E 88 F0 10
18 A5 4D 89 13 85 4D A5 4E E9 00
85 4E 4C 57 84 81 4D 85 57 C8 B1
4D 85 58 A5 55 38 E5 57 C9 8D 50
04 C9 F3 90 17 A5 56 38 E5 58 C9
8C 90 04 C9 F5 90 0A 58 A8 68 AA
A8 01 00 00 84 60 38 A8 60 A4 A9
00 10 00 04 C0 AD 30 04 40 AA E8
AD FE 04 85 40 AD FF 04 85 4E CA
F0 10 18 A5 4D 69 13 85 4D A5 4E
69 00 85 4E 4C 81 63 A0 00 B1 4D
AA C8 B1 4D A8 0E 81 04 0C 0D 84
58 60 AD 00 04 AE 01 04 AC 02 84
85 45 E8 48 48 8A 48 98 48 84 59
A0 FE 04 85 48 AD FF 04 85 4E E8
48 C5 45 F0 10 18 A5 4D 69 13 85
4D A6 4C 80 00 05 1C 4C F5 00 A8
00 00 91 4D C8 A5 59 91 4D 68 A8
59 A9 60 58 C8 A5 59 91 4D 68 A8
58 AA 68 00 85 42 C8 88 F0 08 20
A7 04 4C 27 84 A0 00 8A 38 E5 00
38 43 10 00 F9 10 15 00 85 43 A5
49 13 85 4C 38 85 E9 20 00 03 4C
54 05 85 44 A9 00 85 45 A9 98 85
45 20 1A 85 20 C0 84 48 A5 43 85
47 85 4A 85 4C A9 86 38 E5 43 85
48 85 4D 85 4F 60 C8 47 38 0A 4A
4C 73 84 20 07 84 C0 A5 43 F0 12
A5 4F 85 47 20 C8 84 C8 47 38 04
0A 4C 8A 84 20 C0 84 20 A7 84 20
D0 01 E8 E8 00 D0 00 00 A8 E3 AA
A5 40 80 48 10 A5 41 69 20 85 41
A5 42 69 00 85 42 60 68 20 E3 84
18 A5 40 91 41 60 20 3F 20 83 85
18 A5 40 91 41 60 84 48 85 49 8A
A8 A1 45 AA 49 A4 48 60 49 20 A5
41 E3 01 85 41 A5 42 E9 00 85 42
66 61 40 B1 41 C8 48 30 04 49 4C
E0 01 C8 4D 30 04 0A 4C F3 01 20
3F 05 4E 60 85 4E 60 40 E6 49 E6
4C 01 41 C0 4A 38 04 0A 4C 04 03
C8 4C 38 E5 4A 4C 12 85 A5 45 10
E9 01 85 45 A5 48 65 00 85 45 C8
44 D0 EF A2 00 08 C9 3F 90 03 4C
4E 89 29 7F 85 44 A9 00 85 45 A0
3C 03 40 20 14 03 20 L0 04 9E 41
28 A7 04 E8 E1 00 D0 F3 4C A0 04
A2 01 91 41 20 A7 04 CA D0 F1 4C
A8 04
CHECK= 145020

START=6500
A5 5A 85 5C A5 58 85 5D A0 00 B1
5C C9 FF D0 01 A0 85 60 C8 B1 5C
85 61 C8 B1 5C 85 62 C8 B7 F0 10
A0 00 A4 61 20 39 62 A0 02 A5 62
91 5C 18 A5 5C 69 08 85 5C A5 5D
69 00 85 5D 4C 00 85 C8 B1 5C 85
5E C8 B1 5C 85 5F C8 B1 5C A0 C8
C8 B1 5E C8 FF F0 10 00 80 C7 D1
5E 10 07 00 38 A0 05 91 5C A0 01
A5 60 85 61 91 5C 4C 21 60 A0 00
B1 5E 4C 34 0C 85 12 40 0A 41 50
48 A9 00 85 86 A9 10 85 61 30 A5
60 E5 50 05 86 A5 61 E8 01 85 61
C8 62 D0 EF A1 00 85 5C 85 5D A0
00 B1 60 C9 FF F0 4E C9 FE F0 30
20 C8 66 48 B1 60 85 5E 68 A5 5C
A4 5D 20 80 67 E8 E0 20 50 85 A2
00 L8 84 5D 0E 5L L0 5L D8 E3 20
C0 66 4C 55 66 40 10 A5 60 81 01
85 60 A5 51 65 00 E5 81 60 60.20
C8 66 B1 58 8C 5C 20 C0 60 B1 60
85 5D 20 C0 6E 4C 19 66 60 A0 60
AA 58 08 20 7E 48 F5 0E 20 00 70
58 89 00 23 A6 84 E8 D0 FD A0 00
83 28 29 20 66 85 48 40 0A 48 90
48 A9 00 85 41 A5 A0 85 42 C8 00
F0 10 18 45 41 69 40 85 41 A5 42
59 0 85 42 4C 1D 67 0A A0 A5 48
C9 20 90 4E AE 00 E5 43 A0 39 85
44 38 A5 48 E3 1F E5 40 C8 40 F0
10 18 A5 43 65 00 E5 43 A5 44 69
00 A4 44 6C 43 A7 F3 00 04 45 8A
A0 0 43 44 45 18 E9 40 91 4: 20
70 67 E8 E0 00 D0 ED 60 A0 60 AA
60 60 10 45 41 69 20 85 41 A5 42
69 00 85 42 60 A2 00 91 41 40 20
70 67 00 2A 0E F0 4C 72 67 A0 00
A0 01 99 23 04 00 30 FA A9 05 0D
09 04 A9 20 0C 0A 04 AC 0A 04 C0
C8 00 D0 22 A0 01 0C 0A 04 A1 01
8D 14 04 A9 00 8D 11 04 8D 12 04
8D 13 04 A9 00 8D 10 04 A9 21 85
01 A9 00 85 00 85 02 A9 37 85 03
AE 0A 04 C8 01 E5 03 CA D0 F1 A0
00 8 00 99 04 1F 81 82 99 E3 10
C8 D0 F3 EA EF EA EA EA EA EA EA
EA A0 00 99 41 00 00 20 99 00 21
99 00 22 99 00 23 C8 D0 F1 A1 00
8D 00 04 8D 00 04 8D 10 04 80 0F
04 A9 02 8D 1C 04 38 03 70 A0 14
8D 0E 0C 4D 9E 8F A0 0A 0F A1 07
8D 05 BF 8D 91 BF 8D 09 BF A0 00
8D 07 69 C8 FF FA 10 05 00 E3 ED
07 03 05 21 AE 00 E0 8D 07 61 D0
03 E8 D0 E0 91 00 C8 D0 F2 21 E3
60 20 F8 60 FC 03 04 10 03 30 60
C8 81 A0 0A 04 C9 0A 50 18 C1 14
90 00 40 A9 30 03 0A BF 60 30 E9
14 4E 0C 60 4E A9 31 80 DA 0F F0
30 E1 0A 10 0C 30 0D D8 BF A0 00
A7 00 99 13 04 10 69 30 3C 0F 0F
```

```
[illegible]
```

Program 2.

```
2710  7F2D497F2D4A108E  289
2718  060010BF2D4310BF  214
2720  2D4710BE1E0010BF  1FF
2728  2D451702CC8E0462  24B
2730  9F888E2D62BD90E5  476
2738  17021F27FB9E8830  2B0
2740  02A7B4B159270781  2B6
2748  4E26ED1702B8861E  2D6
2750  B72D47BE04001702  1D1
2758  BA1704FF1701C517  2C8
2760  02C31701F527F581  36F
2768  0310270371810926  15E
2770  138C05FF27E6E780  417
2778  10BE2D43312110BF  25F
2780  2D4320D5810B2615  229
2788  8C040027CFE78430  321
2790  1F10BE2D43313F10  1DD
2798  BF2D43203C815E26  310
27A0  398C04202512E784  28B
27A8  3088E010BE2D4331  307
27B0  A8E010BF2D4320A1  388
27B8  10BE2D47108C0600  1E4
27C0  279A31A8E010BF2D  376
27C8  4710BE2D4331A8E0  33E
27D0  10BF2D4317023C16  1AA
27D8  FF7F810A263C8C05  2FC
27E0  DF2213C704308820  357
27E8  10BE2D4331A82010  247
27F0  BF2D4316FF6310BE  375
27F8  2D47108C1BFF1024  25E
2800  FF5A31A82010BF2D  34E
2808  4710BE2D4331A820  27E
2810  10BF2D431701FC16  269
2818  FF3F810C26061700  20E
2820  EF16FF35815D2605  342
2828  3D3516FF2C811526  2BF
2830  058D4216FF23815F  2EC
2838  260617022E16FF19  1A1
2840  815B260917024C17  187
2848  01C916FF0C811326  2A5
2850  0B341417046B1603  EF
2858  9D8D4C16FEFB3910  3CE
2860  BE2D45A6A2A72110  350
2868  BC2D4326F68660A7  3D5
2870  A417019F3910BE2D  28F
2878  43A621A7A010BC2D  34A
2880  4526F68660B71DFF  41A
2888  17018839E78410BE  312
2890  2D43108C1DDF220E  238
2898  300131211F10C41F  195
28A0  26F610BF2D433934  2C8
28A8  06810D26048DDD20  248
28B0  318120254B4D2B0C  1C6
28B8  8140250681602504  1F6
28C0  84DF8840A78010BE  420
28C8  2D43108C1DFF250C  259
28D0  2704301F200CA7A4  1F1
28D8  301F2006A7A010BF  23B
28E0  2D438C05FF232710  25A
28E8  BE2D47108C1BFF24  30C
28F0  0731A82010BF2D47  243
28F8  1701188E05E0200E  1D1
2900  8660A78010BE2D43  34B
2908  A7A010BF2D433586  341
2910  341010BE2D430660  268
2918  A780A7A01F10C41F  380
2920  26F4359034108D02  2B2
2928  35907A2D42260B86  265
2930  3CB72D42A6848840  354
2938  A7848E0320301F26  251
2940  FC39F6FF00CA807D  4F1
2948  FF022B02CA4039C6  337
2950  7FF7FF02F6FF00C4  530
2958  403934148D034D35  1D3
2960  94327E8E01517FFF  3A2
2968  02F6FF00CA80E184  4A6
2970  27721F9873FF028D  351
2978  C9C1FF2667A7806F  4AC
2980  E4C6FEF7FF028DBA  5E7
2988  E761E884E484A661  523
2990  A7805D260A6CE443  347
2998  79FF0225E920459E  38E
29A0  978D9A1E898D9BE1  46E
29A8  611E892637A6E480  36F
29B0  088B085424FB4D27  282
29B8  32810C2517811125  1B2
29C0  28812A22228B308D  25F
29C8  8627127D0149260D  1B9
29D0  8A2020098B3017FF  2A4
29D8  7626028010811226  1E7
29E0  047301494F359080  255
29E8  1A800B4817FF6026  289
29F0  014C8E2D26A68620  27A
29F8  F4C6608E0400E780  403
2A00  BC05FF23F9398E06  379
2A08  008660A7808C1E01  2B8
2A10  26F93910BE2D47CE  368
2A18  0400A6A0A7C01183  345
2A20  060026F63934167D  222
2A28  2D49261FB6FF008A  2FA
2A30  C081FF26057F2D4A  361
2A38  202F7C2D4AB62D4A  26F
2A40  3164252586FFB72D  398
2A48  49201E7FFF02B6FF  3BC
2A50  008AC081FF26057F  374
2A58  2D49200D8E015186  209
2A60  FF5FA7855CC10823  3D2
2A68  F9359634108D5E10  303
2A70  8C1DDF2218A6A820  330
2A78  A7A0108C1DDF23F5  3F7
2A80  CE1DE08660A7C011  429
2A88  031C0026F0351017  21B
2A90  FF813934108D3631  2F1
2A98  A82010BF2D4B108C  2AB
2AA0  1DFF2213108E1DFF  30B
2AA8  A6A8E0A7A410BC2D  472
2AB0  4B2304313F20F1FE  2F1
2AB8  2D4310BE2D4B31A8  23F
2AC0  E010BF2D4317FE48  37C
2AC8  FF2D43359010BE2D  32F
2AD0  431F20C41F270631  1C3
2AD8  3F301F20F4393414  223
2AE0  17FF16CE04009F83  2E5
2AE8  8E2D75BD90E53514  3AB
2AF0  BD295A27FB813110  324
2AF8  2701038132273E81  1C4
2B00  3327178134270D81  1DB
2B08  35102700FE813626  247
2B10  DF1600E417FEFC16  400
2B18  FBF63414860DBD80  409
2B20  0C863EBD800C9E88  33F
2B28  BF2D4B170136C101  247
2B30  102700C217018A17  1B2
2B38  FED91600B9B6FF22  47D
2B40  8501102600B210BE  23C
2B48  2D4310BF2D4B3414  1FF
2B50  17FEA68E2EE6BD90  4AA
2B58  E517FDFE27F88159  4F3
2B60  2608B62D62BD800F  2BF
2B68  200A814E26E8B62D  2ED
2B70  61BD800F17FE828E  3D2
2B78  2E83BD90E58D3810  3BB
2B80  8E060010BF2D47A6  27D
2B88  A081602604862020  271
2B90  0E81612504804020  1F9
2B98  06811F22028B60BD  272
2BA0  800F10BC2D4B2437  22E
2BA8  8D0917FDAD810327  302
2BB0  2E20D41F20C41F27  26B
2BB8  0139860DBD800FFE  317
2BC0  2D4711831BFF2416  25C
```



FEATURES OF Wordprof include

- Full auto repeat on keys.
- 2K, 100 percent machine code.
- Stores four separate files each 6144 characters in length.
- Files can be swapped.
- Automatic scrolling through text.
- Complete on screen editing.
- Search through a file for a string.
- Dump to printer with double width or normal.
- Files can be saved to tape from Basic.

DRAGON WORDPROF



Simon Tully and a machine-code word-processing program for the Dragon.



Text is typed in the normal way with auto key repeat if a key is depressed for two seconds. You control the cursor with the arrow keys. To insert a single character from the cursor use Shift and right arrow key together.

To delete use Shift and left arrow key. To insert whole lines use Shift and down arrow key. To delete whole lines use Shift and up arrow. Shift and 0 put you into lower case — green on black — as normal. The clear key deletes from the cursor to the end of the line.

Each file is 12 screens in length — 6144 characters.

Pressing the break key gives you a menu with single key commands. Pressing key 1 exits the program and enables you to save files to tape as per addresses displayed.

Pressing key 2 dumps current file to printer up to the cursor position. Make sure the cursor is placed at the end of text required.

Pressing key 3 is a search facility which requires you to enter a target string of up to 19 characters in length.

The search is performed from the cursor position plus one to the end of the file. If the target string is not found the cursor returns to the beginning of text else the cursor is placed on the target string. Pressing Shift and @ continues search for any reoccurrence of the target string.

Pressing key 4 clears the current file. Accidental presses of this key can be corrected by pressing Y to the question "old text? (Y or N)".

Pressing key 5 gives you the option to swap the current file with any of the other three.

Pressing key 6 just returns from menu to the current position in text. ■

Program 1.

```
10 CLS
20 CLEAR200,9995
30 INPUT"START FDDRESS":ST$:PRINT
40 ST=VAL("&H"+ST$)
50 PRINTHEX$(ST);"  ";
60 LINEINPUTA$
70 CO=0
80 FORI=1TOLEN(F$)STEP2
90 P$=MID$(A$,I,2)
100 POKEINT(I/2)+ST,VAL("&H"+P$)
113 CO=CO+VAL("&H"+P$)
120 NEXTI
130 LINEINPUTCH$
140 IFCH$<>HEX$(CO) THENPRINT"error
- retype":GOTO30
150 ST=ST+8
160 GOTO50
```

2BC8	33C820FF2D47FE2D	3B9
2BD0	4333C820FF2D4334	301
2BD8	2017FE37352039BD	287
2BE0	D935148E0400108E	252
2BE8	060010DF2D4710DF	210
2BF0	2D4320048DC43514	22E
2BF8	17FE1816FB5B8E2D	354
2C00	E9A6802705BD800C	384
2C08	20F73917FDEB8E04	3E1
2C10	009F888E2E97BD90	3C7
2C18	E517FD3E27FB8132	40C
2C20	26058E32C8201081	264
2C28	3326058E4AC92007	226
2C30	813426E58E62CA10	38A
2C38	8E0600A684E6A4E7	42F
2C40	80A7A0108C1E0026	2A7
2C48	F28E0400108E0600	228
2C50	10BF2D4310BF2D47	282
2C58	16FF9DE684C840E7	50B
2C60	84C840398E2D4DC6	393
2C68	01BDB505810B2607	22E
2C70	5A27F1301F204581	2A7
2C78	15260A5A27E68608	23A
2C80	BDB54A20F6810D26	386
2C88	044F6F8439812025	245
2C90	DB22098660A78086	396
2C98	205C2020817B24C9	2A5
2CA0	B72D4B4D2B0C8140	274
2CA8	25068160250484DF	298

2CB0	8840C11424B3A7B0	39B
2CB8	5CB62D4EBDB54A20	366
2CC0	A810BE2D433121B6	2EE
2CC8	2D4DA1A0270810BC	286
2CD0	1E0025F6203E8E2D	252
2CD8	4E10BF2D4BA68027	2E2
2CE0	08A1A426E2312120	2C7
2CE8	F410BE2D4B313F10	2BA
2CF0	BF2D4317FDD710BC	3B6
2CF8	1C1F230531A8E020	23C
2D00	F510BF2D47FC2D43	3A4
2D08	B32D471F01308904	204
2D10	00AF63398E0400AF	28C
2D18	63108E060010BF2D	203
2D20	4310BF2D47393012	201
2D28	2C3C2D3D2E3E2F3F	1AC
2D30	40135E5F0A5B0815	192
2D38	095D20200D0D0C5C	128
2D40	03033606051E0006	6B
2D48	0000000620000000	26
2D50	0000000000000000	0
2D58	0000000000000000	0
2D60	000F0E4F4C442054	170
2D68	4558543F20285920	1F1
2D70	4F52204E2900312E	197
2D78	2020204558495420	1BA
2D80	50524F4752414D20	238
2D88	0D322E2020205052	16F
2D90	494E54204F555420	223

2D98	2020200D332E2020	10E
2DA0	2046494E44204120	1C2
2DA8	535452494E470D34	218
2DB0	2E202020434C4541	1A3
2DB8	52204D454D4F5259	24D
2DC0	200D352E20202053	143
2DC8	57415020424C4F43	228
2DD0	4B5320200D362E20	16F
2DD8	202052455455524E	220
2DE0	202020202020200D	ED
2DE8	000D544F20534156	1BA
2DF0	4520544558542046	210
2DF8	494C453A0D424C4F	1FE
2E00	434B0D3153542E53	1F4
2E08	544152543D313533	211
2E10	362020454E443D37	1C1
2E18	3638300D324E442E	19D
2E20	53544152543D3133	22F
2E28	30303020454E443D	1C4
2E30	313931343340D3352	195
2E38	442E53544152543D	23D
2E40	313931343520454E	1B7
2E48	443D32353238390D	198
2E50	3454482E53544152	238
2E58	543D323532393020	1B3
2E60	454E443D33313433	1DF
2E68	340D43534156454D	200
2E70	224E414D45222C53	1E4
2E78	544152542C454E44	23E
2E80	2C300D007072696E	222
2E88	74696E6720696E20	2C9
2E90	70726F6365737300	2FF
2E98	5357415020315354	233
2EA0	20424C4F434B2057	202
2EA8	4954483A0D4B4559	215
2EB0	203220202020324E	152
2EB8	4420424C4F434B0D	1DC
2EC0	4B45592033202020	19C
2EC8	2033524420424C4F	1E6
2ED0	434B0D4B45592034	1D8
2ED8	2020202034544820	170
2EE0	424C4F434B0D0044	1BC
2EE8	4F20594F55205741	224
2EF0	4E5420444F55424C	238
2EF8	452057494454483F	224
2F00	0D2859204F52204E	1BD
2F08	2900FFFFFFFFFFFF	623

'Engines on...check... flaps to 10 degrees... check...increase throttle, release brakes. Increase throttle to full power ...watch air speed indicator. Aircraft taxiing, increasing speed...170 knots... rotate, observe vertical speed indicator... increase elevator angle.

Take off achieved!'

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BBC ADE AND BCPL

John Dawson takes a look at two languages for the BBC.

THIS ARTICLE is not a comparative review in the usual sense. Both of the languages are good and complete implementations and my main purpose is to compare the uses to which you may put them, not to recommend a best buy. The ADE system is designed and marketed by System, 12 Collegiate Crescent, Sheffield and BCPL is an Acornsoft language.

ADE: An ordinary assembler produces one machine-code instruction in the object code — the machine code that will control the computer — for each line of source code — the instructions that you type into the computer. That is a low level language. Basic, or BCPL, or Forth are high level languages because each instruction that you type may make the computer carry out hundreds or thousands of machine code instructions. The Basic instruction X = SQR(Y), for example, would require at least a page of instructions if it was written down in machine code or assembler.

A macro assembler lies somewhere between the ordinary low level assembly language and the familiar high level languages. A "macro" is a set of low level instructions that you have written for your own purposes which you can insert into the object code program simply by typing the name of the macro into the source code.

Once the macro is written it can be put into a library and taken out and used whenever you wish. In other words you can build a set of high level instructions to your own design and fit them into place in your programs just like Basic commands.

ADE is supplied with a disc containing utility and demonstration programs. The demonstration is impressive and the SYSLIB file has a number of useful macro definitions. For example, figure 1 lists macros that will send an FX or an asterisk command to the machine operating system, and handle an error in your program.

Each of the macro definitions is well documented and you should be able to see how easy it is to create your own high level instructions. Parameters are values that are passed from the main program into a macro or a subroutine. Parameter passing is very important since it determines the usefulness of *any* language, not just assembler.

The ADE macro assembler has good facilities to pass parameters into macros. The Error macro shows how a number may be used in the source code and, also, how the address of a string can be passed.

The E part of ADE is a sophisticated text editor for preparing and modifying the source code. Each package that appears has to have its own editor; BCPL has two, one large and one tiny, and Multi-Forth 83 has another. It is a complex job trying to learn three or four different sets of editing key functions and I try to use View for all my source code editing.

Each of the others has advantages — better printer control, more advanced search and replace facilities — better block moves and so on — but they take so long to look up in the manuals that you use more time than you save.

In ADE's defence I must say that the editor includes all the facilities you might need for word processing although the commands are at a comparatively low level. Nevertheless, it can be used for general-purpose text preparation, the ADE manual was written with the editor for example, and you could do much worse than to standardise on the ADE system. This is particularly true since ADE have rewritten the editor to work in an 80-column mode and with the second processor.

The third part of the ADE package is the SPY front panel monitor. "Front panel" refers to the days — about six years ago! — when microcomputers, and big PDP minicomputers as well, displayed the internal state

(continued on next page)

```
and calculator() be
$(
  let final.answer = 0
  writes ("Calculator *n")
  newline()
  final.answer := expression()
  writef (" %N", final.answer)
  delay(200)
$)
and expression() = valof
$(
  let answer,newno = 0,0
  let operator = '+'
  until operator = '=' do
  $(
    newno := readn()
    switchon operator into
    $(
      case '+': answer := answer + newno; endcase
      case '-': answer := answer - newno; endcase
      case '*': answer := answer * newno; endcase
      case '/': answer := answer / newno; endcase
    $)
    operator :=rdch()
  $)
  resultis answer
$)
```

Figure 4. A four function calculation written in BCPL.

```
10 REM DISC LABEL PRINTING PROGRAM
20 WIDE = 14
30CLS
40LI = 8:REM NUMBER OF LINES ON LABEL
50INPUT"HOW MANY TRACKS ON DISC" F$
70REPEAT
80  PRINT "TITLE    ";
90  INPUT LINE T$
100  PRINT "TITLE 2 ";
110  INPUT LINE T2$
120  INPUT "HOW MANY COPIES " C
130  *FX6,0:REM LINE FEEDS ARE SENT TO
THE PRINTER
140  VDU2
160  REPEAT
170     VDU1,27,1,69:PRINT "BBC COMPUTER
        ";F$; "TRACKS"
180     PRINT:VDU1,WIDE:PRINT T$
190     PRINT:PRINT T2$
200     FOR L=0 TO LI-5:PRINT:NEXT L
210     C=C-1
220     UNTIL C=0
240  VDU3
250  UNTIL FALSE
260END
```

Figure 2. A quick Basic program for printing disc labels.

Figure 3.

BBC computer
80 tracks
ELECTRONIC MAIL
Disc No.

(continued from previous page)

of the machine on serried ranks of lights on the front panel. Each light represented a binary bit in an internal register or buffer and the state of each bit could be altered by equally serried ranks of switches.

SPY can be entered from a running program or from the command state. The front panel monitor commands allow you to view a section of memory either from an address set by you or from the program counter. This means that the current section of a machine code program is listed in the memory block. You can jump automatically to the address following a JSR — Jump to subroutine instruction — and search for a specific byte pattern.

Further commands allow you to modify the contents of memory locations one at a time or in blocks, shift blocks of memory and compare the contents of two blocks. You can alter the 6502 registers, single-step your way through a program, continue running a program and start execution from a specified address. It's a good monitor.

Comprehensive instructions

ADE is completed by a comprehensive instruction manual which is properly printed, well laid out with a table of contents and an index, and plenty of examples.

The real difference between a good macro-assembler and the Basic interpreter supplied with the BBC Microcomputer is exemplified by the program listed in figure 2. I dislike untidy labels on my floppy discs and so I wanted to print a set of labels in a standard format. Figure 3 shows how the disc titles appear when they are printed on single-width continuous sticky labels.

It took about 15 minutes to write the program in figure 2, and a further 15 or 20 minutes to edit it until I achieved the layout that I wanted. Basic makes this type of job terribly easy. The program remains in the computer all the time and can be summoned up on to the screen for instant modification. Speed is wholly unimportant in this application. The number of lines to be printed can be altered very quickly until the program stays in synchronisation with the sticky labels.

All of these things are more difficult with an assembler. A macro assembler scores heavily where you are writing your own special-purpose interpreter, a print formatting program for example — there's one included in its source code form with ADE — high-speed data acquisition in a laboratory, text handling programs for which Basic is less well suited, and so on.

Figure 1. Macro definitions from the ADE SYSLIB library.

```
******FX******
;3 parameters
;A register value
;X register value
;Y register value
;note values can be expressions
;as well as constants
;examples
;   FX   4,1,0
;   FX   200 MASK,0
FX MACRO
LDA    £@1
LDX    £@2
LDY    £@3
JSR    &FFF4
ENDM
```

```
******ERROR******
;cause error using BRK
;two parameters
;@1=error number
;@2=error message
;example
;   ERROR   147,Value too big
ERROR MACRO
        BRK
        DFB   @1
        ASC   '@2'
        BRK
        ENDM
```

```
******STAR******
;issue simple star * command
;1 parameter, text of command
;examples
;     STAR   BASIC
;     STAR             ;catalog

;Note position of CONT, since
;ENDM cannot have a label.
STAR MACRO
       LDX   £>.L1
       LDY   £<.L1
       JSR   &FFF7
       JMP   ..CONT
.L1  STR   '@1'
..CONT
       ENDM
```

BCPL: This is a compiler language, unlike Basic, and was written by Martin Richards in 1967. It has been a stable language since about 1972 and the version offered for the BBC Micro is a full implementation of the BCPL standard Level 0 with some extensions and machine specific procedures.

A compiler works rather like an assembler; after typing in the source code for a program, the language reads the instructions, checks them for mistakes and compiles an object program which will be smaller than the original source and will run very quickly. The source code can be erased from the computer after storing it on disc.

The BBC version compiles the source code to an intermediate code — Cintcode — which is then interpreted by the BCPL Rom. This half-way approach is not the compromise that it seems and BBC BCPL does offer speed advantages over an already very fast Basic together with some portability between different machines.

If the program turns out to contain an error when the object program is executed, you must reload the source code, correct the error using a word processor or text editor, recompile the object code and try again. The language you are using may or may not give you an indication of where the program failed.

BCPL uses compiler

You can see that a number of files have to be loaded into the computer during the compilation process. BCPL uses the compiler itself and at least three other programs that are resident in memory at the same time or overlaid. If you want to debug the program you will need to load at least one other file and possible two or three more.

I wouldn't try to use BCPL without one disc drive and for serious work I think you'll need two drives. This will allow you to keep the compiler and the test programs on one drive, and source and object code on the other.

The user guide does explain how you can separate the development programs from the other utilities for testing the Cintcode but if you start to write a program of any size, and keep backup copies of the source and object code, your disc will fill up rapidly.

BCPL is a block-structured language like Pascal and Algol. The syntax of BCPL allows you to write well structured programs which do not use Goto instructions or labels. Indeed, the Goto instruction in BCPL will only work within a comparatively limited range.

Calculates a new answer

Unlike Basic, which separates data into numbers — integers and reals — and strings, BCPL makes no distinction and you can happily add the letter G to the number 173 to produce a nonsense result. This naivety on the part of the language is actually very helpful in many applications.

Figure 4 shows two declarations which act as a simple four function calculator on signed 16 bit integers. The function — a procedure which returns a value — "expression" declares three local variables and then loops round the block of commands following:

until operator = '−' do

until the end of the calculation is reached. Every operator that is read calculates a new answer which is eventually passed back to the procedure "calculator" and printed.

It took about 15-20 hours before I felt any familiarity with BCPL at all. The user guide supplied with the BCPL ROM and floppy disc, is 450 pages long, packed with information and insufficient on its own. The manual states:

"The book *Beginning BCPL on the BBC Microcomputer* by Paul Martin published by Acornsoft provides a suitable introduction to the language."

That may well be so but try and get hold of a copy before you believe it exists.

BCPL is like the Skywave Multi-Forth 83 package in that it contains its own 6502 assembler. Also, like Multi-Forth 83, BCPL has the facility to run more than one task simultaneously. The BCPL assembler produces relocatable object code which can be loaded and run at any address.

You can write a source code program that will produce relocatable machine code using the ADE macro assembler but you need to plan how you are going to do this very carefully in advance of starting to type. ■

CONCLUSIONS

- Once you have become familiar with the BCPL language progress in programming will be quite fast. An additional floating point package is available containing trigonometric and logarithmic functions. While you require the BCPL Rom to run the intermediate code produced by the BCPL compiler, you can obtain a program which produces stand-alone machine code which will execute on either the BBC Micro or other 6502 based-machines.
- The recent price cut from £95 to about £50 for the standard BCPL system makes the language much more attractive for experimenting and learning.
- ADE is a superb macro assembler. The great advantage of assembly languages for hesitant programmers like myself is that while progress is slower, at least you know what's going on.
- Most of the jobs that you might want to do with assembly language could be done with BCPL but ADE is far better supported by all the assembly language books written for the 6502.

A wealth of Peripherals for your Spectrum!

By RICK BRAVO

Since the 48K Spectrum was launched the opportunities it offered has attracted peripheral manufacturers throughout the world.

One of these manufacturers was bound to emerge as the "brand leader" and in the case of the Spectrum this turned out to be DK'tronics. The company is based in Saffron Walden in Essex and proudly boasts a history dating back to the ZX80. All the company's products are manufactured in England at their own factory and they have now established themselves as world leaders, exporting to over 30 countries.

Below you will find a review of their range which now includes over 16 products, all of which are available for the Spectrum and Spectrum + models.

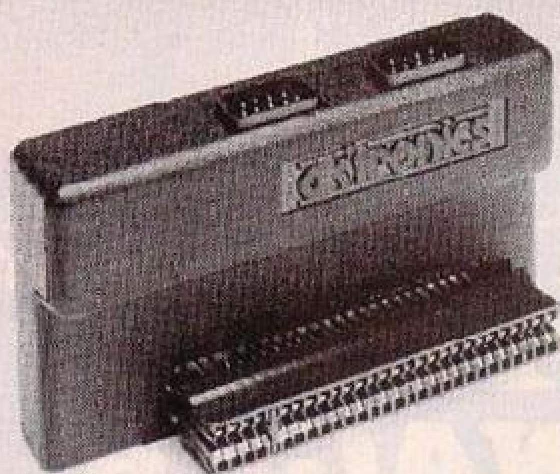
Keyboard



The DK Microdrive Compatible Keyboard is the best selling keyboard in the world and is now used by around 10% of all U.K. Spectrum owners. It is microdrive compatible and offers more key functions than any other keyboard in its price range. The stepped keys and space bar make it even easier to use. It is constructed from high density black ABS and has 52 keys and a full width space bar. A separate numeric keypad of 12 red keys including single entry 'delete' plus single entry 'decimal point' facilitate fast numeric data entry.

From good computer shops everywhere at only £37.50 or direct from DK'tronics, add £1.50 post & packing.

Dual Port



The first port simulates 6,7,8,9, & 0 Keys. The second port simulates in (31) command.

The port will accept any Atari style joystick.

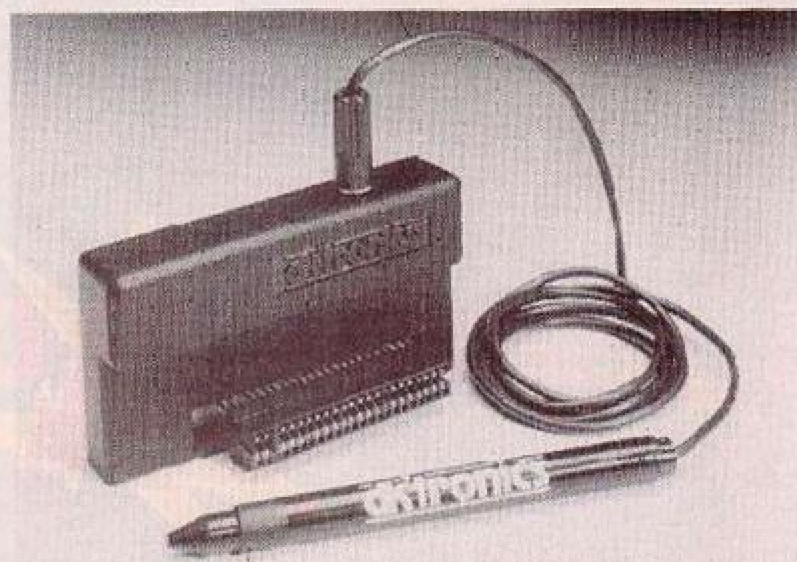
It will run any software. That is:-

(a) Using Keys 6,7,8,9 & 0.
(b) Having redefinable key instructions.
(c) Using in (31) (i.e. Kempston).

This Dual Port interface interconnects with the existing range of DK'tronics products to form the most comprehensive range of Spectrum peripherals available from any manufacturer.

From good computer shops everywhere at only £13.00 or direct from DK'tronics, add £1.50 post & packing.

Light Pen



This highly successful Light Pen for the Sinclair Spectrum plugs neatly onto the rear of the Computer or the rear of the printer connector. The operating software now runs faster and supports 16 pre-defined instructions. You can change all the colours (Border, Paper, Ink), draw circles, arcs, boxes, lines and insert text onto the screen (ideal for diagrams etc.) Save & load completed or partly completed screens onto or from the tape.

There are also features to draw Free Hand and animate on the 48K Spectrum, you can retain and animate 5 screens.

You can also use the machine code on its own in your own programs for selecting out of a menu, playing games etc. All entry points necessary are given. The Pen works down to pixel level with pixel accuracy.

From good computer shops everywhere at only £19.95 or direct from DK'tronics, add £1.50 post & packing.

From **dk'tronics**® Saffron Walden, Essex CB11 3AQ tel:(0799)26350

3 Channel Sound Synthesizer

Any microcomputer is capable of manufacturing sound, however, in order to produce a single octave 'C' note with a frequency of 8372Hz the signal needs attention over 16,000 times per second.

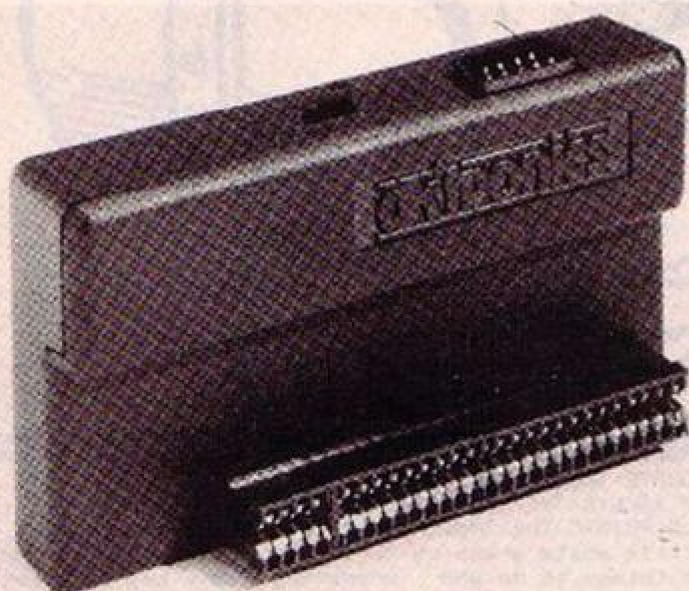
To produce software capable of perfoming just this one task would be difficult if not impossible, especially when you consider that to produce arcade type sound effects requires even greater attention.

The production of these sound effects without the constant attention of the processor is now possible thanks to the AY Sound Chip. its flexibility makes it essential for a wide range of applications including music synthesis and sound effects generation, continuing the monitoring and production of sound after the initial command.

More often than not realistic sounds require more than one effect and this function is provided by 3 independently controlled channels, as an example compare the sound produced by the single note of 'C' with that produced by the chord 'C' and you will know just what I mean, likewise producing the sound of an explosion using all 3 channels gives games a totally new dimension.

Add to this the ability to alter the pitch tone and shape of the sound you have produced and it's flexibility is unlimited. In simple terms, imagine the note you have produced as a calm sea, by altering the pitch and shape you can produce waves, the top of the wave corresponds with the maximum volume and pitch of the note, which like the wave itself rises and falls.

Programmable



At last! A fully programmable joystick interface with feed through connector that really works!

Now you can run ANY software from ANY supplier with the DK'tronics fully programmable joystick interface. It comes complete with machine code software and can be programmed in seconds to give full 8 directional joystick movements plus five capabilities and will accept any Atari/Quickshot type joystick. A catalogue is now available showing the full range of products available from DK'tronics the world's leading Spectrum peripheral manufacturer. The through connector enables other add-ons to be plugged into the rear.

From good computer shops everywhere at only £22.95 or direct from DK'tronics, add £1.50 post & packing.



Speech Synthesizer

The speech synthesizer uses the popular SL0/256 speech chip and has an almost infinite vocabulary. It is supplied with a text to speech converter for ease of speech output creation. Everything you wish to be spoken is entered in normal English, without special control codes or characters, it is therefore extremely easy to use. The voicing of the words is completely user transparent and the computer can carry on its normal running of a program while the speech chip is talking.

Although there are only 26 letters in the alphabet, letters have a totally different sound when used in different words. For example, the "a" in Hay is much longer and softer than in Hat. When you speak you automatically make adjustments because you know just how a word should sound. Not quite so easy with a computer. After looking at other speech synthesizers we decided that it was essential that the DK'tronics Spectrum Speech would offer a simple system that would enable the user to produce realistic speech that was instantly recognisable.

The solution to the problem was extremely complicated, it required hours of programming to enable the computer to look at the individual letters that make up each word and compare their relative position to each other before deciding on the appropriate sound.

I consider this to be the best Spectrum Speech Synthesizer on the market. From good computer shops everywhere at only £24.95 or direct from DK'tronics, add £1.50 post & packing

Centronics

The new Dk'tronics Parallel Centronics Interface will link your Spectrum to any printer with a standard centronics input. As the choice is vast, you can select the printer exactly suited to your needs.

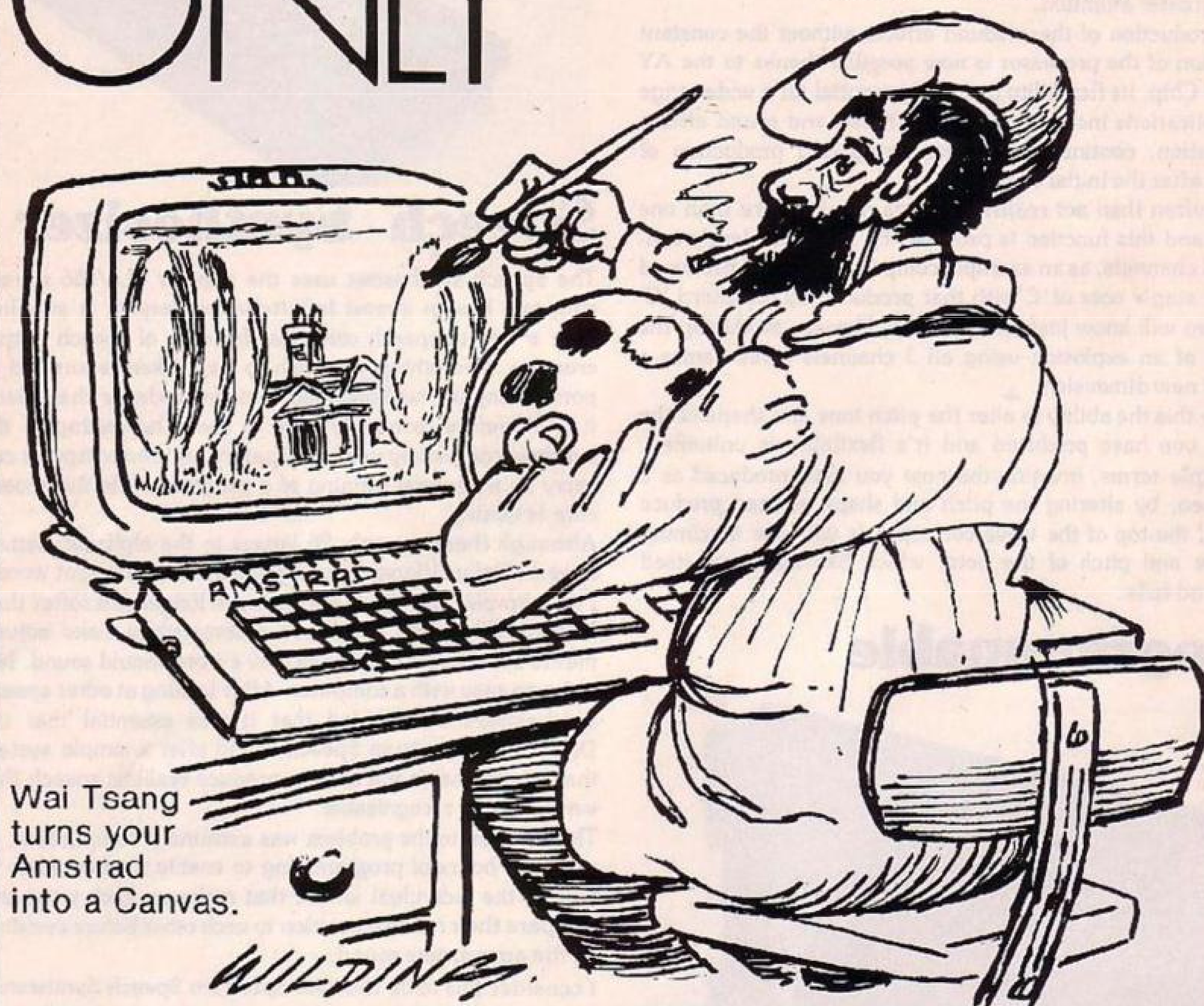
Features of the interface include: Runs all parrallel centronics type printers: Controlling software fully relocatable; Interfaces with any software using the printer channel e.g. Tasword Dev Pack etc; LList Lprint recognised. High res screen dumps; All control codes allowed through to printer; Fully microdrive compatible.

Supplied with full instructions and controlling software. From good computer shops everywhere and sensibly priced at only £39.95 or direct from DK'tronics, add £1.50 post & packing.

ARTISTS ONLY

ARTISTS ONLY is a drawing program for the Amstrad. If offers line drawing, circle plotting, and airbrush facilities, as well as routines for saving a drawing on tape or taking a screen dump on a printer. You can use the keyboard or a joystick. Full instructions are included in the program.

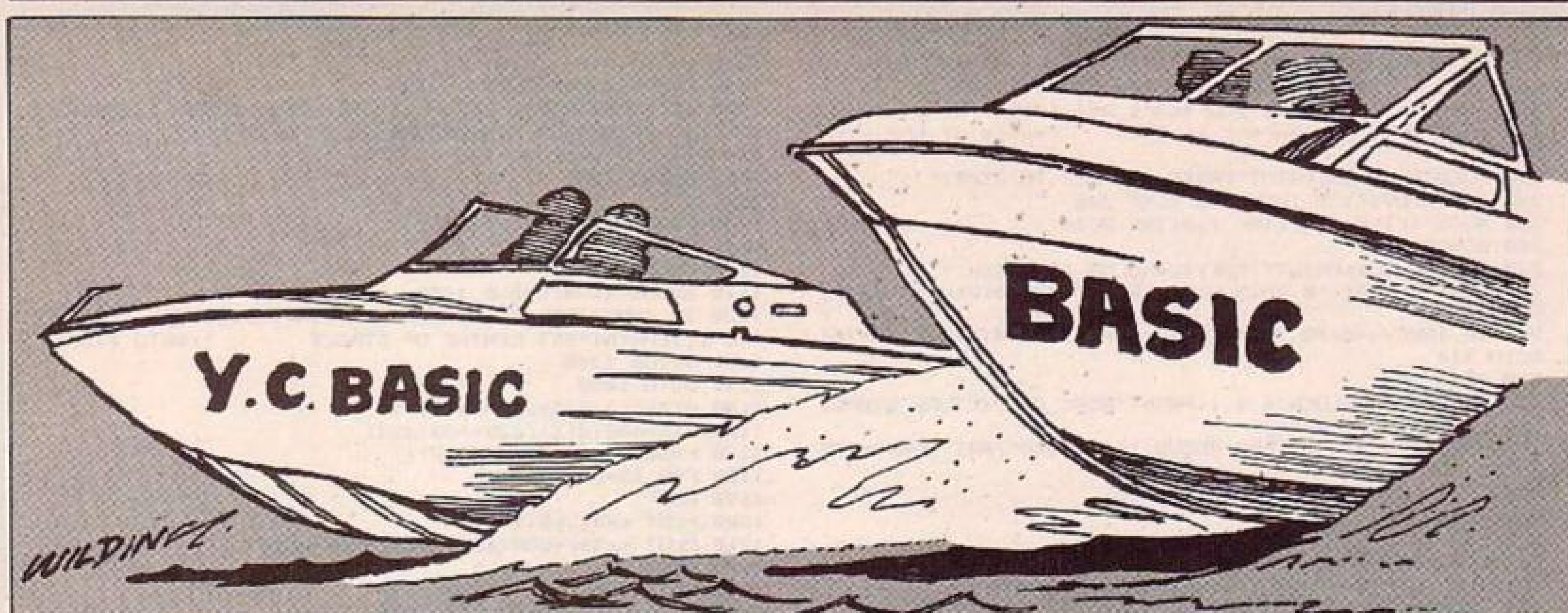
As it stands the program does not allow you to change the Ink and Paper colours. It is reasonably well structured, however, and you should have no trouble adding further options. These could also include a free-hand drawing facility and a fill routine.



Wai Tsang turns your Amstrad into a Canvas.

```
10 REM*************************************
20 REM*Program:ARTISTS ONLY
30 REM*A utility cr something to do on a rainy day*
40 REM*By Wai Tsang and MEMPHIS SOFT*
50 REM*29/12/84 tc 1/1/85,1 am*
60 REM*Written so that it might ge:                publishe
d in YOUR COMPUTER.*
70 REM*************************************
80 CLS:PRINT" This program turns your CPC 464 into a w
orking sketch pad with facilities such as an AIR BRUSH
,a LINE DRAWER,a routine which enables you to draw CIR
CLES easily,and last but not least a RUBBER."
90 PRINT:PRINT" You can also save you drawings on
 cassette to be finished later or to be  kept and used
 in your cwn programs."
100 PRINT" The final drawing can be dumped to a   prin
ter.To do this or to save you          drawing on cassell
e press (G) and then  follow the simple yes or no ques
tions."
110 PRINT:PRINT" If you are a sucker for your own work
s of art and you don't have a printer thenyou should l
oad the programs ontc the   screen using PROGRAM 2 and
 then admire  your master piece fresh from the tape
you saved it on earlier"
120 LOCATE 10,24:PRINT"PRESS A KEY"
130 IF INKEY$<>"" THEN 140 ELSE 130
140 CLS:PRINT" The instructions are simple.Position
the little white graphics cursor to the place where yo
u want things to be and   press the right key to chang
e the mode."
150 PRINT:PRINT" The cursor is moved using the joystk
  but if you pick the all key board optionthen you use
 the numeric key pad where  UP=8,RIGHT=6,DOWN=2,LEFT=4
.
160 PRINT" To set the position of a point or to   turn
 something on and off press the FIREBUTTON on joystk o
r if you're using the key board then or the numeric pa
d      press '5'."
170 PRINT:PRINT" For the different modes its 'L' for
  LINE DRAWER,'C' for CIRCLE DRAWER,'A'   for AIR BRUS
H,'E' for ERASER and 'Q' to QUIT.'
180 PRINT" The size of the AIR BRUSH's spray can  be c
hanged using the UP and DOWN ARROW  KEYS on the cursor
 cluster."
190 LOCATE 10,24:PRINT"PRESS A KEY"
200 IF INKEY$<>"" THEN 210 ELSE 200
210 CLS:PRINT" Lastly for the screen dump and the save
to cassette press (Q)UIT and you can    still return t
```

```
o your drawing after      saving it or you can take a
rest and    load it in later and then finish it."
220 PRINT" Incidently you start off in the LINE   DRAW
ING mode with the cursor in the      centre of the scre
en."
230 LOCATE 10,15:PRINT"PRESS ANY KEY TO START"
240 IF INKEY$<>"" THEN 250 ELSE 240
250 MODE 1:INK 0,27:INK 1,0:INK 2,26
260 GOSUB 1460
270 LOCATE 8,1:PRINT"(K)EYBOARD OR (J)OYSTK."
280 IF INKEY(37)=0 THEN U%=11:D%=14:J%=20:O%=4:F%=12:G
OTO 310
290 IF INKEY(45)=0 THEN U%=72:D%=73:J%=74:O%=75:F%=76:
GOTO 310
300 GOTO 280
310 GOSUB 1460:LOCATE 1,1:PRINT"WORK ON PICTURE STORED
 ON CASSETTE (Y/N)"
320 IF INKEY(43)=0 THEN GOSUB 1460:LOAD"!ART WORK":GOT
O 350
330 IF INKEY(46)=0 THEN GOTO 350
340 GOTO 320
350 ss%=10
360 x%=320:y%=200
370 GOSUB 1460:LOCATE 1,1:PRINT"LINE DRAWER"
380 LOCATE 15,1:PRINT"SET FIRST POINT "
390 D%=0
400 GOSUB 1430
410 GOSUB 1290
420 GOSUB 1390:GOSUB 1430
430 GOSUB 1240
440 GOSUB 1390
450 IF INKEY(F%)=0 THEN GOTO 470
460 GOTO 400
470 IF o%=1 THEN GOTO 540
480 a%=x%:b%=y%
490 o%=1
500 SOUND 1,300
510 LOCATE 15,1:PRINT"SET SECOND POINT"
520 FOR S=1 TO 120:NEXT
530 GOTO 400
540 MOVE a%,b%
550 DRAW x%,y%,1
560 o%=0
570 SOUND 1,200
580 LOCATE 15,1:PRINT"SET FIRST POINT "
590 FOR l=1 TO 100:NEXT
600 GOTO 400
610 '*****Pixel brush routine*****
620 GOSUB 1460
630 LOCATE 1,1:PRINT"AIR BRUSH "
640 LOCATE 11,1:PRINT"OFF"
650 LOCATE 23,1:PRINT"DIAMETER=":LOCATE 32,1:PRINT ss%
660 SP%=0
670 GOSUB 1430
680 IF INKEY(0)=0 THEN ss%=ss%+2:LOCATE 32,1:PRINT ss%
:IF ss%>48 THEN ss%=48
690 IF INKEY(2)=0 THEN ss%=ss%-2:LOCATE 32,1:PRINT ss%
:IF ss%<3 THEN ss%=3
700 GOSUB 1290
710 GOSUB 1240
720 IF INKEY(F%)=0 AND sp%=0 THEN sp%=1:SOUND 1,200:LO
CATE 11,1:PRINT"ON ":GOTO 730 ELSE IF INKEY(F%)=0 AND
sp%=1 THEN sp%=0:SOUND 1,200:LOCATE 11,1:PRINT"OFF":FO
R L=1 TO 150:NEXT:GOTO 730
730 GOSUB 1390
740 IF sp%=1 THEN 750 ELSE 670
750 FOR l%=1 TO 5
760 r%=INT((RND*ss%)-(ss%/2))
770 r2%=INT((RND*ss%)-(ss%/2))
780 PLOTR r%,r2%,1
790 NEXT
800 GOTO 670
810 '*****Rubber routine*****
820 GOSUB 1460
830 LOCATE 1,1:PRINT"ERASER":LOCATE 8,1:PRINT"OFF"
840 rb%=0
850 GOSUB 1430
860 GOSUB 1290
870 GOSUB 1240
880 GOSUB 1400:GOSUB 1430
890 IF INKEY(F%)=0 AND rb%=0 THEN rb%=1:SOUND 1,200:FO
R l=1 TO 150:NEXT:LOCATE 8,1:PRINT"ON ":GOTO 900 ELSE
IF INKEY(F%)=0 AND rb%=1 THEN rb%=0:SOUND 1,200:LOCATE
 8,1:PRINT"OFF":FOR L=1 TO 150:NEXT:GOTO 900
900 IF rb%=1 THEN GOTO 910 ELSE GOSUB 1390:GOTO 850
910 FOR v%=-2 TO 2
920 MOVE x%-3,y%+v%:DRAW x%+3,y%+v%,2
930 NEXT
940 FOR v%=-2 TO 2
950 MOVE x%-3,y%+v%:DRAW x%+3,y%+v%,0
960 NEXT
970 GOTO 850
980 '*****Circle drawing subroutine*****
990 GOSUB 1460
1000 LOCATE 1,1:PRINT"SET CENTRE OF CIRCLE"
1010 GOSUB 1240
1020 GOSUB 1430
1030 GOSUB 1290
1040 GOSUB 1390:GOSUB 1430
1050 IF INKEY(F%)=0 THEN cx%=x%:cy%=y%:SOUND 1,200:LOC
ATE 1,1:PRINT"SET CIRCUMFERENCE OF CIRCLE":FOR l=1 TO
200:NEXT:GOTO 1080
1060 GOSUB 1390
1070 GOTO 1010
1080 GOSUB 1430
1090 GOSUB 1290
1100 GOSUB 1240
1110 GOSUB 1390:GOSUB 1430
1120 IF INKEY(F%)=0 THEN ox%=x%:oy%=y%:SOUND 1,200:LOC
ATE 1,1:PRINT"SET CENTRE OF CIRCLE        ":GOTO 1150
1130 GOSUB 1390
1140 GOTO 1080
1150 d1%=cx%-ox%:d2%=cy%-oy%
1160 d1%=ABS(d1%):d2%=ABS(d2%)
1170 r=SQR((d1%^2)+(d2%^2))
1180 FOR a%=1 TO 360
1190 DEG
1200 PLOT cx%,cy%,1
1210 PLOT cx%+r*COS(a%),cy%+r*SIN(a%),1
1220 NEXT
1230 GOTO 980
1240 IF y%<1 THEN y%=1
1250 IF y%>400 THEN y%=400
1260 IF x%<1 THEN x%=1
1270 IF x%>640 THEN x%=640
1280 RETURN
1290 IF INKEY(U%)=0 THEN y%=y%+4
1300 IF INKEY(D%)=0 THEN y%=y%-4
1310 IF INKEY(J%)=0 THEN x%=x%-4
1320 IF INKEY(O%)=0 THEN x%=x%+4
1330 IF INKEY(69)=0 THEN 620
1340 IF INKEY(58)=0 THEN 810
1350 IF INKEY(36)=0 THEN 370
1360 IF INKEY(62)=0 THEN 980
1370 IF INKEY(67)=0 THEN GOSUB 1480
1380 RETURN
1390 '*****Graphic cursor routine*****
1400 IF TEST(x%,y%)=1 THEN p=1
1410 PLOT x%,y%,2
1420 RETURN
1430 IF p=1 THEN PLOT x%,y%,1 ELSE PLOT x%,y%,0
1440 p=0
1450 RETURN
1460 LOCATE 1,1:PRINT"
     "
1470 RETURN
1480 REM *QUIT,SAVE OR PRINT OUT*
1490 GOSUB 1460
1500 LOCATE 1,1:PRINT"SCREEN DUMP (Y/N)"
1510 IF INKEY(43)=0 THEN GOSUB 1700:GOTO 1540
1520 IF INKEY(46)=0 THEN GOTO 1540
1530 GOTO 1510
1540 GOSUB 1460
1550 LOCATE 1,1:PRINT"CASSETTE SAVE (Y/N)"
1560 IF INKEY(43)=0 THEN GOSUB 1650:GOTO 1590
1570 IF INKEY(46)=0 THEN GOTO 1590
1580 GOTO 1560
1590 GOSUB 1460
1600 LOCATE 1,1:PRINT"(A)NOTHER,(Q)UIT, OR (C)ONTINUE"
1610 IF INKEY(69)=0 THEN CLS:GOTO 310
1620 IF INKEY(67)=0 THEN |BASIC
1630 IF INKEY(62)=0 THEN RETURN
1640 GOTO 1610
1650 REM** cassette save **
1660 SPEED WRITE 1
1670 GOSUB 1460
1680 SAVE "!ART WORK",B,&C000,&4000
1690 RETURN
1700 REM** Screen dump. **
1710 GOSUB 1460
1720 DIM i%(320)
1730 pixln=413
1740 FOR k%=1 TO 28
1750 pixln=pixln-14
1760 FOR l%=1 TO 319
1770 GOSUB 1870
1780 i%(l%)=p1%+p2%+p3%+p4%+p5%+p6%+p7%
1790 NEXT
1800 PRINT#8,CHR$(27);CHR$(75);CHR$(2);CHR$(64);
1810 FOR j%=1 TO 320:PRINT#8,CHR$(i%(j%));:NEXT
1820 PRINT#8,CHR$(i%(320))
1830 NEXT
1840 PRINT#8,CHR$(15)
1850 ERASE i%
1860 RETURN
1870 p1%=TEST(l%*2,pixln)
1880 p2%=TEST(l%*2,pixln-2)*2
1890 p3%=TEST(l%*2,pixln-4)*4
1900 p4%=TEST(l%*2,pixln-6)*8
1910 p5%=TEST(l%*2,pixln-8)*16
1920 p6%=TEST(l%*2,pixln-10)*32
1930 p7%=TEST(l%*2,pixln-12)*64
1940 RETURN
```



GO-FASTER BASIC

Richard Taylor with an ingenious way of speeding up Sinclair Basic by overcoming the Spectrum's ponderous method of searching through lines.

SINCLAIR BASIC is rather slow to say the least. Moreover, in common with most other machines Spectrum programs become slower as they increase in length. This is a result of the way in which the computer finds a line when you make a reference to it. For instance if you have a program in memory and the computer comes across the statement Goto 9999 it looks at the very first line of the program and asks itself "is this line 9999?", the answer will be no so it will go onto the next line and ask the same question. It will carry on doing this until it eventually finds 9999.

Even though the Spectrum hunts through the lines at a lightening fast rate the length of the program ensures that this can slow a program down considerably, especially if the program makes frequent use of subroutines right at its end. One of the methods used to combat this slowing effect is to put important subroutines that need to run at maximum speed at the start of the program and less important routines, such as initialisation and data statements near the end.

Although helpful this method is by no means perfect. For instance, what if you've got a lot of program that needs to run at maximum speed, it can't all be at the start. Secondly, it tends to be unnatural to structure programs in this way, most people like to write programs in the same order as they are executed, i.e. initialisation routines etc. first. In most programs this slowing down effect isn't too important, but Basic games using animation of any sort are slow enough to start with without any additional speed reducing effects.

There is, however, a better way of solving the problem that prevents the computer from needing to go through the whole rigmarole of searching through the program for a particular line. Once a program is Run the addresses of program lines in memory don't change. It's only when you add to or edit a program etc. that any address changes occur. Say you have a Goto 5000 statement in your program. Every time this Goto is encountered line 5000's address has to be laboriously found. But, like the line numbers, its address is a constant.

It seems pointless to spend a great deal of time and effort for a result that you know will be the same as the last time it was calculated. If the line number reference in a Goto is exchanged for its equivalent address then no searching is necessary. Lo and Behold, this is exactly what my program for the 48K Spectrum does. In fact, Gosub and Next statement are speeded up in a similar way. There are not the only commands to divert the execution of a program: Continue, Run and Return do as well but these are a damn sight harder to speed up and, in the cases of Run and Continue, aren't much used anyway.

When writing the program I've attempted to abide by the following two aims:

- Faster Basic must work with all Basic programs even if they were typed in without Faster Basic being in memory at the time.
- Faster Basic should be totally user transparent, i.e. it should do its job without any special action from you, such as calling machine code.

The 1.25K of machine code is sandwiched between Ramtop and the user definable graphics area. Before running remember to save it, just to be on the safe side. All the Basic does is to poke the machine code into memory: a task that takes a couple of minutes. When it's successfully finished the machine code can be saved with:

SAVE "FAST CODE" CODE 64058,1310

You can reload at any time with:

CLEAR 64057. LOAD ""CODE

Initialising the program is a simple task, just type:

RANDOMIZE USR 64082

You'll get a new startup message, informing you that the machine code is up and running. You'll get the same message if you use New, it replaces the usual Sinclair copyright message.

Obviously you don't want to have to use memory addresses directly in Goto and Gosub statements but stick with the good old system of using line numbers. The computer therefore has the burden of having to remember both the line number and its corresponding

Figure 1.

MEMORY CONTENTS	236	49	48	48	14	0	0	100	0	0
WHAT MEMORY CONTENTS REPRESENT	GO TO	1	0	0	BINARY NUMBER TO FOLLOW	100 IN FLOATING POINT BINARY				

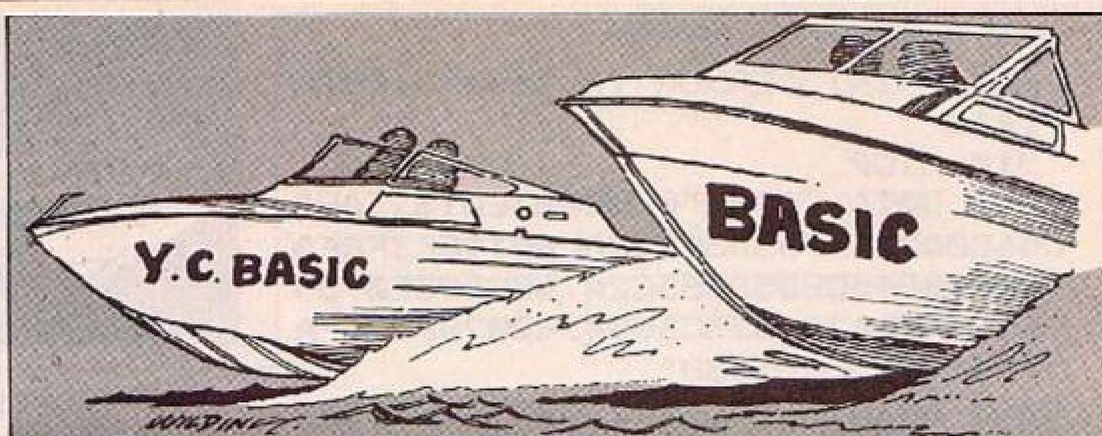
address for each Goto and Gosub. Because of the way programs are stored in memory this isn't too difficult to organise. When you list a program you don't see the whole story; parts of the program — as its stored in memory — aren't shown, mainly because these parts are for internal use by the computer and look like gibberish to anything but a computer. One such example of concealed program is the six bytes of data that follow every number used in the program. The first of these six bytes always has the value 14; a number which signifies to the listing routine that it shouldn't attempt to display the contents of the following five bytes.

These bytes contain the binary form of the preceeding decimal number. When a program is run these binary forms save the computer a great deal of time by being able to use these binary forms directly without having to convert the decimal representation that you typed in originally. For instance the statement Goto 100 is represented in memory as in figure 1. There's a similar format for a Gosub statement.

Faster Basic replaces the binary representation of the line number with the address of the line. This is perfectly legal as the computer no longer requires the binary bit as it no longer uses the line number directly — it's there for your reference only. Occasionally in a program you find a Goto or Gosub with not just a line number but a whole expression, ie. Gosub 2000+a*300, so the value of a determines which line is jumpted to. In such an instance Faster Basic doesn't alter anything, and when encountered it is treated as normal. This isn't a great handicap as statements of this sort are pretty rare anyway.

Speeding up a Next statement poses much more of a problem since there are no conveniently placed free bytes where the address of the line can be dumped and, secondly, it's not obvious where the Next must branch to, i.e. where's the For associated with that particular Next? The way to get around the first difficulty is simple — if there is no storage area then make one. A dummy binary representation area is inserted just after the name of the variable in the Next statement as shown in figure 2.

The second problem isn't quite as easy to solve. Clearly it's necessary to find the line number of the For connected with the Next in question. You could find it by locating the last For statement before the Next with the same variable. However, this could prove a slow process and not totally reliable. In any case,



you've always got to make allowances for people who derive great pleasure from watching other people's programs crash, they might be evil enough to write something like:

```
10 GO TO 40
20 NEXT a
30 STOP
40 FOR a=0 to 100
50 GO TO 20
```

A far safer alternative is to not mark the line to which the Next is to jump to at all initially, just fill the five storage bytes with zeroes. The first time the Next is used in the program the computer will think to itself "look, that Next hasn't been marked with the address of the line it should jump to, I'd better find out what it is". The appropiate line, and therefore its address can be found by the usual method of searching through the program — in the same way as a Next would be treated normally. Before the jump to the line is made its address is carefully noted in the first two of the Next's five byte store, along with the statement number within that line. The following time the Next is used no searching is necessary — the address of the For line is already there.

One problem with this is that a program's length increases by six bytes for every Next in the program. This, along with the fact the Faster Basic machine code has already consumed over 1K above Ramtop, means that if a program was crammed into the Spectrum's memory to start with then, chances are, after Faster Basic has been at it, it won't fit at all — well, you can't win them all. If this is the case then you'll get an 'Out of Memory' report when you try to run the program. Be warned, once a program's been 'compiled' it'll never run again without Faster Basic in memory. The moral of the story? Always keep a copy of the pre-compiled version.

When using the Faster Basic you'll often find yourself with a blank screen while a program's being compiled, either if you Run it or try and use Goto — be patient the program hasn't crashed. A Basic program is recompiled every time it's re-entered after you've modified it in any way — and I include loading or merging in another program in that — even from Microdrive. Autorun is handled — loading an autorun program will result in a short delay while the program's compiled before it bursts into action.

Because of the mischievious way the shadow Rom in Interface 1 operates every time an Interface 1/Microdrive command is used Faster Basic is forced inactive. After such a command use Randomize USR 64061.

You'll get the start message printed up again but the program in memory is preserved. Unfortunately this method can only be used with Interface 1 statements used as direct commands, it's not possible to use these commands in an actual program at all.

It's difficult to give even a rough estimate of the speed increase gained by using Faster Basic. A program 30K or so in length can be considerably improved speed wise especially if it wasn't written with the most speed dependant parts at the start. The most important factor is, of course, the amount of times Nexts, Gotos, and Gosubs are used in the program; but I think you'll agree that they are well used commands.

Figure 2.

MEMORY CONTENTS	243	97	14	?	?	?	?	?
WHAT MEMORY CONTENTS REPRESENT	NEXT	a	FIVE STORAGE BYTES TO FOLLOW	FIVE BYTES TO STORE ADDRESS OF LINE				

```
 10 REM    'FASTER  BASIC'
 20 REM
 30 REM      48K Version
 40 REM    By Richard Taylor
 50 REM
 60 CLEAR 64057
 70 LET a=64058
 80 FOR l=0 TO 20
 90 LET t=0: READ v,a$
100 IF LEN a$/2<>INT (LEN a$/2)
THEN GO TO 500
110 FOR c=1 TO LEN a$ STEP 2
120 LET x=CODE a$(c)-48-7*(a$(c
)>="A")
130 LET y=CODE a$(c+1)-48-7*(a$
(c+1)>="A")
140 POKE a,16*x+y
150 LET t=t+16*x+y
160 LET a=a+1
170 NEXT c
180 IF v<>t THEN GO TO 500
190 NEXT l
200 PRINT "Data OK - Now SAVE"
210 STOP
```

(listing continued on next page)

(listing continued from previous page)

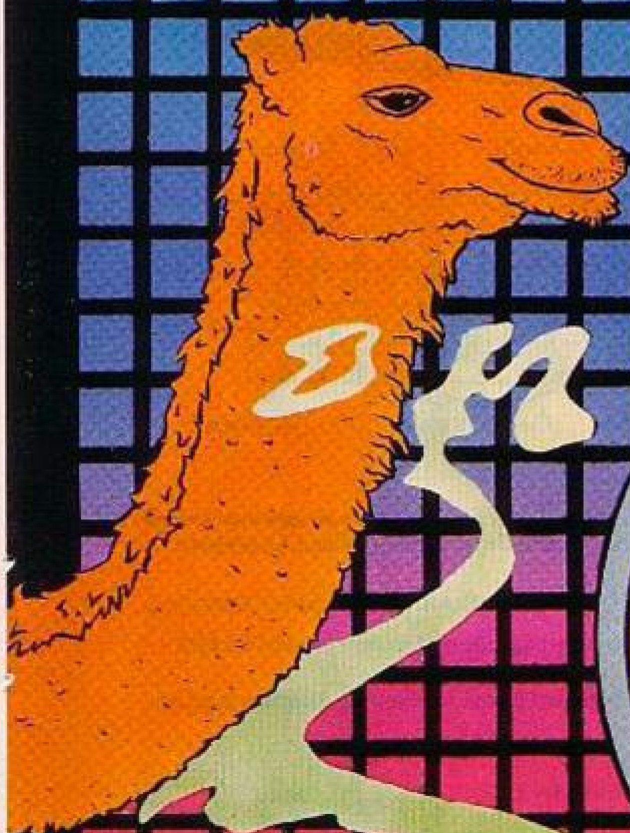
```
 500 PRINT "ERROR in line ";8000
+1*10
 510 STOP
8000 DATA 7936,"0000003E01323AFA
CD6B0DAFED7B3D5CE1FDCB019EC3F8FA
F3ED4BB45CED5B385C2A7B5CD93E07D3
FE3E3FED472AB25C5D5436002BBC20FA
D9ED43B45CED5338"
8010 DATA 5419,"5C227B5CD9ED53B2
5C21003C22365CEB363E2DF72B2B223D
5C21B65C224F5C11AF15011500EBEDB0
EB2B22575C2322535C224B5C36802322
595C360D23368023"
8020 DATA 6193,"22615C22635C2265
5C3E38328D5C328F5C32485C21230522
095CFD35C6FD35CA21C61511105C010E
00EDB0FDCB01CECDDF0EFD363102FBCD
6B0DAF323AFA1104"
8030 DATA 5325,"FBCD0A0CFDCB02EE
1848802746415354455220424153494
27204F50455241544494E472053595354
454D204279205269636861726420546
796C6F7220202041"
8040 DATA 7042,"75677573742C3139
3834A0FD363102CD9517CDB016AFCD01
16CD2C0FCD171BFDCB007E200C2A595C
CDA711FD3600FF18E42A595C225D5CCD
FB1978B1C237FCDF"
8050 DATA 7997,"FE0D28C7FDCB3046
C4AF0DCD6E0D3E19FD964F328C5CFDCB
01FEFD3600FFFD360A01CD93FC76FDCB
01AEFDCB304EC4CD0E3A3A5C3CF52100
00FD7537FD752622"
8060 DATA 6448,"0B5C210100221650
CDB016FDCB37AECD6E0DFDCB02EEF147
FE0A3802C607CDEF153E20D778119113
CD0A0CAF113615CD0A0CED4B455CCD1B
1A3E3AD7FD4E0D06"
8070 DATA 6172,"00CD1B1ACD97103A
3A5C3C281DFE092804FE152003FD340D
010300117050214450FDCB0A7E280109
EDB8FD360AFFFDCB019EC34FFB3E1001
0000C3AFFBED4349"
8080 DATA 6794,"5C2A5D5CEB212FFC
F52A615C37ED52E56069CD6E19200BCD
B819CDE8193E01323AFAC1793DB0282D
C503030303 2BED5B535CD5CD55163E01
323AFAE122535CC1"
8090 DATA 7443,"C5132A615C2B2BED
B82A495CEBC1702B712B732B72F1C345
FB21FEFF22455C2A615C2DCD5B595C1B
3A445CC357FDE7CDBF16FD340DDF0600
FE0D287AFE3A28EE"
8100 DATA 10477,"21F7FCE54FE779F
DCB0C7E200FFEECCA97FDFEEDCAA8FDF
EF3CAE9FDFEEA2855FEFACA81FDFED52
00AFEE6CA52FAFEEFC2441B4F3E01323
AFA79C3441BCD541F"
8110 DATA 7869,"D27B1BFDCB0A7E20
71FDCB097E208A3A3AFAA7C477FE2A42
5CCD6E193A445C282AA7C2EC1B477EE6
C078281FED7B3D5CFD3600FFC9C1FDCB
0C7E20073A3AFAA7"
8120 DATA 7281,"C477FE2A555C3EC0
A6C0AFFE01CE0056235EED53455C235E
2356EB192322555CEB225D5C571E00FD
360AFF15FD720DCAA8FC14CD8B192802
CF16DFFE0D28B7FE"
8130 DATA 9106,"3ACAA8FCC38A1CCD
821CDFFECBC28A1CC1EF0238EBCDE934
389CC3A8FCCDC2FD3047ED535D5C5E23
56234EC33AFFD1FD660D24E333ED4B45
5CC5E5ED733D5CD5"
8140 DATA 6333,"011400CD051F18D5
2A5D5C7E23FE0E2807CD1B2D30F5B7C9
EB210500197EFE0D2804FE3A20F0EB37
C9CD821CC3671E2A5D5C237EFE0E20FA
223BFA35CD6C1C01"
8150 DATA 6142,"06002A3BFA340922
5D5CFDCB374EC22E1C2A4D5CCB7ECAD8
1D2322685CEFE0E20FC00238CDDA1DD8
2A3BFA23E523237E235E23562A685C01
0F00094F7BBE201A"
8160 DATA 7458,"237ABE2B20142323
79BE28067EE1E5232377E15E23564FC3
3AFF5E2356D5237EEBF5CD6E19F1ED4B
535CB7ED42EBC1E17323722377237123
704FC33AFF2A535C"
8170 DATA 7954,"2B11F300CDAEFE38
08CD03FF2A5D5C18F011EC0037F52A53
5C2BD5CDAEFE3809CDD0FED12A5D5C18
F1D113F13F30E6AF323AFAC97EFE3A28
15237EE6C037C023"
8180 DATA 7416,"23223BFA4E2346E5
09444DE11600C5CD8B19C1D018E3E7CD
C2FD3806110002C38B19DFCD3B2D2A5D
5C23E5CD991E6960CD6E19ED4B535CB7
ED42EBE173237223"
8190 DATA 5313,"36012323223225D5C
C9E7237EFE0D2808FE0E2820FE3A20F2
2B010600CD55162323E52A3BFA5E2356
010600EB09EB722B73E1360E06052336
0010FB23225D5CC9"
8200 DATA 3385,"2A535C19CD541F38
0C56235EED53425CFD710ACF14D13EC0
A6C079C345FD"
```

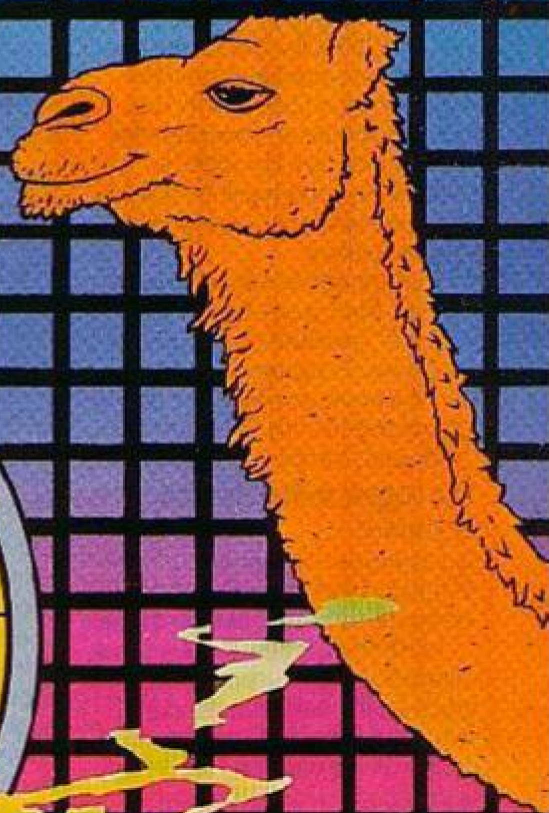


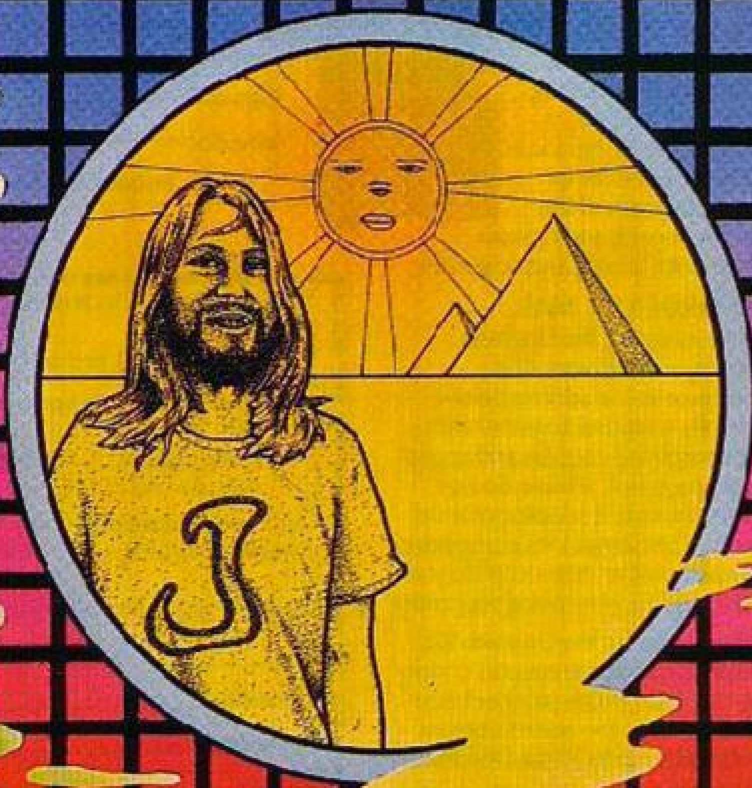
Psychedelia

A Light Synthesiser











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Included – the new Spectrum + User Guide and Companion Cassette

The new User Guide has over 80 pages of information, including a handy BASIC dictionary. The Companion Cassette provides an interactive tour of the new keyboard, and includes three entertaining arcade games.

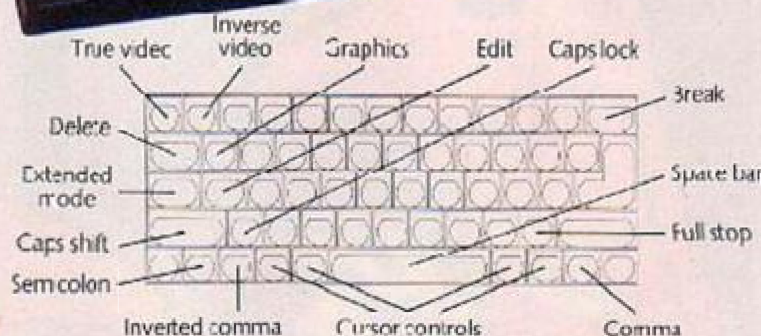
TO ORDER BY MAIL:

When ordering the Upgrade Service, send off your 48K Spectrum to the address below, carefully wrapped, together with the completed coupon and appropriate payment. (Please do *not* return the mains adapter, manual or other ancillaries.) Your upgraded computer will be despatched to you within 10 days of receiving your order.

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All prices include VAT, post and packing, User Guide and Companion Cassette.

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Surrey, GU15 3PS.

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TELSOFT



A reminder of how to use the Telsoft service.

THE PROGRAMS given here will enable Spectrum and BBC owners to download via *Your Computer's* Telsoft service. First type the hexloader for your machine — figure 1 — and then enter the machine code — figure 2. On the BBC you call the service by entering

CALL &6A00

while Spectrum owners must type

RANDOMIZE USR 60000

So far OE Ltd's Telemod 2 and VTX 5000 modems have been tested with the service, but it also works with a number of other makes.

To find out what is available on Telsoft and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bit/s services.

When a program you want to download is available, make sure your modem is set up and dial the number appropriate to your modem's speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received, you will see "OK" printed if there were no errors, otherwise the program will wait for the blocks to come round again.

When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run the program.

Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)";A$
40 A=EVAL("&"+A$)
50 IF A>&6F87 THEN 280
60 IF A<&6A00 OR A>&6FE7 THEN 20
70 PRINT "A" ";
80 INPUT ":" B$,C$
90 IF LEN(B$) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6F87
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>70 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 :A9CBA0FEA20120F4,4C6
6A08 :FF20616C20486DC9,20A
6A10 :31F00BC934F0E9C9,4CB
6A18 :35F0064C0C6A4C17,280
6A20 :6AA90C20E3FFA9EB,4B2
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA982,363
6A38 :A20220F4FFA9C890,4C8
6A40 :FEA20020F4FF6099,4BC
6A48 :0C20E3FF20F76B99,439
6A50 :15A20120F4FFA030,3EB
6A58 :A9FFB89985FD0FA,5B7
6A60 :A915A20120F4FF20,394
6A68 :0C6C90F8200C6C00,34D
6A70 :FBA0008477847834,416
6A78 :79847AE47B857020,3B8
6A80 :056DA57029F0C930,4B9
6A88 :D0E2200C6C80D099,46B
6A90 :7100C82005DDC009,364
6A98 :D0F0A000A5742980,422
6AA0 :D000A51C85761085,354
6AA8 :1065736577200C6C,2B9
6AB0 :B0B520E3FFC82005,524
6AB8 :6DC010C0F0A57320,435
6AC0 :B263200C6C00A0C5,3CC
6AC8 :7AF000696020E3FF,47B
6AD0 :20E7FF4C676A200C,34F
6AD8 :6C800CC578F000A9,48C
6AE0 :5B20E3FF20E7FF4C,4AC
6AE8 :676AA573A039856F,43E
6AF0 :D00E20E7FFA90020,3B8
6AF8 :E3FF4CE36B4C676A,469
6B00 :A000847A0478200C,2C9
6B08 :6CB0F2917620D560,477
6B10 :C8C475D0F1200C6C,45A
6B18 :00E3C57AF00B4938,4CE
6B20 :20E3FF20E7FF4C67,4B3
6B28 :61200C6C00CFC578,3C1
6B30 :F00B695820E3FF4C,447
6B38 :A7AA50A7A820E7FF,429
6B40 :A573A0A90099B56F,3F6
6B48 :A58AC902D05B2007,419
6B50 :63A9C820556CA955,3B3
6B58 :2030EA950200556C,299
6B60 :A915F20120F4FF20,391
6B68 :F76BF471CB80B985,505
6B70 :6FD0E19800F7A90C,4A4
6B78 :20E3FF20A56DA95A,437
6B80 :0502796F05039907,3D7
6B88 :20006E20FB6D20A8,2D3
6B90 :63A90520006EA9D0,2DA
6B98 :20E3FF20FB6DA9D2,502
6BA0 :20E0FF4C0C6AA955,3BF
6BA8 :2030EA996200556C,2DE
6BB0 :4C6AEBA475200C6C,2D2
6BB8 :B4D0FA200C6C200C,316
6BC0 :6C4C4B6B4C6C6AA9,336
6BC8 :2020E3FFA96F20E3,43D
6BD0 :FFA96D20E3FF60A9,51E
6BD8 :9CA000A6BAE002D8,41E
6BE0 :0BA21320F4FFA212,3B7
6BE8 :20F4FF60A27720F4,4C6
6BF0 :FFA29620F4FF60A9,553
6BF8 :9CA000A6BAE00200,41E
6C00 :EBA25320F4FFA252,4E7
6C08 :20F4FFA01AA99A85,44F
6C10 :BFB47EA991A20020,30D
6C18 :F4FFB009C007D005,443
6C20 :63A84C0C6AA47E20,2D1
6C28 :496CC6BFD0023B60,374
6C30 :A58AC902D0062079,369
6C38 :A6E00EC6A095A201,447
6C40 :20F4FF99A47EB00F,55C
6C48 :A0BAA2D2CAEBCA00,5AA
6C50 :FBAA60A700E47EAB,458
6C58 :20496CB3D0FAA47E,449
6C60 :60A9E0A000F2FF20,452
6C68 :F4FFA90085EAA90C,460
6C70 :20E3FF20AB6DA904,3E4
6C78 :20006EA709E5B2A9,2F0
6C80 :6F0583A00020FB6D,39C
6C88 :20156DC741F000C9,370
6C90 :42F011C743F0174C,3A2
6C98 :616CA903A20120F4,335
6CA0 :FF4C0B76CA90A203,3C4
6CA8 :20F4FF4CB76CA900,433
6CB0 :A20420F4FFE6DAA5,4CE
6CB8 :7C20E3FFA47E20AB,46B
6CC0 :6DA90820006E20FB,2C4
6CC8 :6DA01720156DC941,2D0
6CD0 :F000C942F011C943,413
6CD8 :F0174C616CA907A2,372
6CE0 :0120F4FF4C096DA9,37F
6CE8 :07A20320F4FF4C09,314
6CF0 :6DA907A20420F4FF,3D6
6CF8 :E6BAA5BAC902D009,443
6D00 :A9E8A000A20120F4,3E8
6D08 :FFA57C20E3FF2033,495
6D10 :6C20536C6020AB6D,2E3
6D18 :A90520006E20FB6D,2C1
6D20 :20AB6DA90520006E,274
6D28 :20FB6D20AB6DA905,36D
6D30 :20006E20FB6D20AB,2DE
6D38 :6D047EA90320006E,2A9
6D40 :A9D220E0FF857C60,4DB
6D48 :A9DC20E3FF20AB6D,3EF
6D50 :A90720006EA9A885,306
6D58 :[illegible],3A1
6D60 :FE6D20AB6D20F96D,3C0
6D68 :20996D20996D20AB,317
6D70 :6EA90A20006E20FB,2C6
6D78 :6E20A36DF9022000,278
6D80 :6E20F86D20AB6D20,34E
6D88 :E3FFA9D220E0FF48,5AE
6D90 :A90FA20020F4FF68,3DC
6D98 :60A90820006E20F8,2D7
6DA0 :6020AB6D6020AB6D,33A
6DA8 :20AB6D20E7FF20E7,445
6DB0 :FF604829F06A6A6A,3FE
6DB8 :6A0930C93A30031E,1F1
6DC0 :690720E3FF60290F,313
6DC8 :0930C93A30031B65,1F0
6DD0 :0720E3FF60457B85,3AE
6DD8 :7BA20BA57B2A900C,30B
6DE0 :A57B4908857BA57A,390
6DE8 :4910857A267A267E,299
6DF0 :CAD0FBA020E3FFCE,5AC
6DF8 :B.B2C90D00F6C06E,4F7
6E00 :B67DAAA92020E3FF,478
6E08 :CAD0FAA67D60297F,55F
6E10 :D000A9B620F4FFE0,4FD
6E18 :00F012A97FC92080,3C3
6E20 :0EC900F00AC98DF0,3A1
6E28 :06C907F002A9306D,2D1
6E30 :857CB67D847E9991,448
6E38 :A20120F4FFA903A2,404
6E40 :0720F4FFA9964200,403
6E48 :20F4FF9B2902F0F4,4BA
6E50 :A47CA997A20920F4,41F
6E58 :FFA903A20420F4FF,464
6E60 :A991A20020F4FFB0,49F
6E68 :09C007D0056B684C,2C1
6E70 :0C6A057CA67DA47E,3DC
6E78 :A0FA7EB67D099AD2,14A
6E80 :0020F4FF9B2901F0,3CD
6E88 :0B8996A20920F4FF,40B
6E90 :901D900130A67DA4,340
6E98 :7E60444F574E4C4F,2B1
6EA0 :4144494E47204B45,215
6EA8 :4E550D3120202052,193
6EB0 :4543454956450D34,1F2
6EB8 :2020205345542042,1AE
6EC0 :6175642052617465,2E6
6EC8 :0D25202020455849,1B8
6ED0 :5420544F20424153,20D
6ED8 :49430D454F544552,217
6EE0 :204F554D4245520D,1FA
6EE8 :2020555345204354,1EC
6EF0 :524C204720544F20,1F5
6EF8 :52455445520E2054,254
6F00 :4F204D454E552029,1ED
6F08 :0D53455420545241,200
6F10 :4E534D4954204261,24E
6F18 :756420526174650D,292
6F20 :4120202037352042,16F
6F28 :6175640D42202033,1FC
6F30 :303020426175640D,209
6F38 :4320313230302042,188
6F40 :6175640D53455420,253
6F48 :5245434549564520,223
6F50 :426175642052.74,2C3
6F58 :650D50524F475241,23D
6F60 :4D20204C4F414445,1F2
6F68 :4420206F6B0D5052,20D
6F70 :45535320414E5920,215
6F78 :4B455920464F5220,210
6F80 :4D454E550D202020,1A2
```

Figure 1. Spectrum.

```
5 REM SPECTRUM 48k          fig 1
10 REM Hex Code Loader
15 CLEAR 59000
20 POKE 23658,8: CLS : PRINT
30 INPUT "Start Address ";a
50 IF a>61135 THEN GO TO 280
60 IF a<60000 THEN GO TO 20
70 PRINT a;
80 INPUT ":";b$
85 IF b$="END" THEN GO TO 280
90 IF LEN b$<>20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN PRINT ":";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN LET e=1
320 RETURN
```

Figure 2. Spectrum.

```
60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66ED3D,631
60016 :30EDCD47EF30FB3D,3AF
60024 :BBEDFE31CA99EAFE,69A
60032 :35CAB7EAC366EA3D,5D0
60040 :15ED3EFACD84ED3D,5FD
60048 :15EDC9CD15EDC36A,553
60056 :EACD66ED11E5EE06,50C
60064 :B03EFF121310FC3D,45B
60072 :15EE11CDEE06173E,3D2
60080 :20171310FCCD1FED,3DA
60088 :30F0CD50EDCD1FED,3BB
60096 :30F03265EF3E0032,3E9
60104 :6CEF326FEF3270EF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :091165EFCD1FED0A,501
60136 :AAEA1312CDEBEC0D,552
60144 :20F23A69EFE68020,51A
60152 :0D214B3C3A60EFBE,36C
60160 :004709226BEF0E00,3DA
60168 :11CDEECD1FED309A,47F
60176 :12130CCDEBEC79FE,45C
60184 :1020F03A60EFCD01,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEFBE2B133E5011,326
60208 :E0EE12133E00:2CD,340
60216 :D7ECCDAA6ECC3AAEA,6B
60224 :CD1FEDDAAAEA2170,518
60232 :EFBE20E121E5EE3A,524
60240 :6BEF856F3E008C67,3CC
60248 :3E00BE2000CD07EC,40F
60256 :3E21320B5CC3FFEE,402
60264 :3E00326FEF3270EF,3C7
60272 :ED5B6BEF0E00CD1F,40C
60280 :CDDAAACA3273DFCE,634
60288 :EBEC3A6BEFFE0020,506
60296 :0E3A69EFE6803A73,432
60304 :EF12130C3A6AEFB5,3FC
60312 :20DCCD1FEDDAAAEA,5DB
60320 :216FEFBEC22DEBC1,5B4
60328 :1FEDDAAAEA2170EF,5A2
60336 :BEC22DEB3E6F32E2,509
60344 :EE3E6332E3EE3E00,490
60352 :32E4EE3AB85CFE21,501
60360 :2E03CD15EECD07EC,553
60368 :C1A6EC21E5EE3A6E,5C5
60376 :EF056F3E00C6736E,422
60384 :0E21E5EEED4B66EF,561
60392 :0C7EFE00C28DEA23,4FC
60400 :0E20F63EFACD84ED,5B9
60408 :3E01D3FEC366EACD,5E8
60416 :1FED30FDC3DDCAF3,574
60424 :0603AFD3FF10FB3E,3DB
60432 :4BD3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,385
60448 :32805C32485C3E01,250
60456 :D3FE21915CC09CF0,560
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD0FEC,442
60488 :CD64ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,5BF
60504 :CDA0ECCD84ECCDA6,661
60512 :CC233E00CD0FECCD,4CF
60520 :84EC23CDA3EC3E03,490
60528 :CD8FECCD84ECC9CD,688
60536 :A3EC3E07CD8FECCD,561
60544 :A4EC23C97FFF00CA,520
60552 :CDEBED23C384ECFE,651
60560 :00C0F53E20CD00ED,520
60568 :F13DC30FECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CDEBED3EFF320C5C,574
60592 :C9F513E6F0CB1FCB,60C
60600 :1FCB1FCB1FF630FE,4CF
60608 :3AFAC6ECC6071213,490
60616 :F1E6AFF630FE3AFA,6A6
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E20772310FC3E,339
60648 :0077C9E52170EFAE,53B
60656 :77C50E0B7EA7C817,449
60664 :300D7EEE0C773A6F,3C9
60672 :E7EE10326FEF3721,3C5
60680 :6FEFCB1623CB1600,358
60688 :28E2C1E1C9110501,394
60696 :216A00CD050DC93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C0
60720 :ED7BE601F602D3FE,548
60728 :AF2177EF35200237,2FC
60736 :C9CD77ED3BEBC9CD,6F0
60744 :47EEDBFECBC037C9,5E4
60752 :F5DBFF3A01EFFE00,5C7
60768 :20043E3618023E37,187
60768 :D3FFDB7FF1C9F53A,675
60776 :01EFFE0020043E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00DBFFE60037CBDB,59.
60800 :FFE60237CBD0FFE6,626
60808 :302004DB7FA7C93A,3E0
60816 :01EFFE0020043E37,397
60824 :18023E36D3FFDB7F,452
60832 :C9CD47ED3A73EFDB,5DE
60848 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9CED5E5F5FE,70D
60864 :7F2013CDF9EDFE0C,537
60872 :280CFE0C20053E28,2BA
60880 :D73E0DD710103E20,34F
60888 :D73E08D73A885CFE,4EB
60896 :2120033E08D73E5F,2E6
60904 :D73E0807F1E1D1C1,640
60912 :C9FE07281CFEC028,4F3
60920 :19FE0C2814FE0028,3B8
60928 :10FE0D280CFE20FA,367
60936 :0FEEFE30FA11EE3E,48A
60944 :00C93E07C9CD680D,32C
60952 :3E02CD01163E1832,1C4
60960 :895CC93E121601CD,302
60968 :1122C93E121600CD,257
60976 :1122C93D5DE53E02,3E0
60984 :CD01163D47EE3DFB,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :385CCB6F280C3A08,28F
61008 :5CF5213B5CCBAFF1,4C3
61016 :A7C93739F5111000,3DE
61024 :CD10EDF1C9444F57,4D6
61032 :4E4C4F4144494E47,2D4
61040 :204D454E55003120,216
61048 :2020524543454956,276
61056 :4500352020204578,217
61064 :697420746F204261,32B
61072 :7369630028205573,2DF
61080 :652053796D626F6C,393
61088 :205368696674202D,30B
61096 :204700746F205265,2C9
61104 :7475726E20746F20,39C
61112 :4D454E55[illegible],27D
61120 :4E544552204E554D,309
61128 :4245522000000000,1C1
```

EXTENDED VIC BASIC

THE PROGRAM, when run, provides the Vic-20 with an extra 25 keywords where 23 are commands and two are functions. The extra commands utilise sound, colour and graphical aspects of the computer. There is a resolution of 160 by 192. Double height and user-definable graphics are catered for in the package. There is also a special key scanning function to allow multi-key input similar to the Inkey function on the BBC machine. Colour manipulation to produce animation is also a key feature. The use of tokenised keyboards results in no speed decrease.

A list of commands is provided on printer paper plus two demo programs, Poly Organ and Beekeeper. The demos contain no Pokes.

As the program is of total machine code it will be impossible to convert even to a machine like the CBM-64. Most computers anyway have a reasonably extensive Basic.

Loading — Press Shift Lock; press Run Stop; depress Shift Lock and press Play on tape.

The Extra commands:

OPERATION MODES: Each mode command initialises the normal Vic-20 colour and sound channels.

MODE0 — sets the normal text screen.

MODE1 — sets normal screen with 192 definable characters.

MODE2 — sets the 15 line screen with double height characters.

MODE3 — sets the hires screen with 192 lines of 160 pixels.

COLOUR COMMANDS: all colour commands can be used in all modes.

INK x — sets the current ink colour to x (0-15). Values above 7 sets the multicolour mode.

AUX x — sets the auxilliary colour to x (0-15). For use in multicolour graphics.

VDU x,y — sets the screen colour to x (0-15) and the border colour to y (0-7).

GCOL x — changes each colour on the screen by x amount for example with GCOL1 black becomes white and white becomes red and yellow becomes black etc. GCOL7 reverses the process above the GCOL4 causes a flashing effect. Don't use with multicolour characters.

GCOL x,y — changes everything with colour x (0-15) to colour y (0-15).

SOUND COMMANDS.

VOL x — sets volume to level x (0-15).

CHAN x,y — sets sound channel x (0-3) to value y (0-255).

SOUND I,J,K,L — gets all four channels to the values of the variables.

HI-RES COMMANDS.

CLG — clears the hi-res screen.

SET x,y — plots a pixel at column x (0-159) and line 7 (0-191) in the current ink colour. The top left corner is the origin (0:0).

RESET x,y — unplots the pixel at column x (0-159) and line y (0-191).

SCREEN COMMANDS.

AT x,y — puts cursor at column x (0-21) and line y (0-22). For use in modes 0-2.

CLS — clears text screen. Don't use in mode 3.

INV — inverts screen display. A second

Program 2.

```
0 SYS58648:PRINTCHR$(8)SPC(49)"P
LEASE WAIT !":S=0:A=36:B=8192:GO
SUB6:A=2:B=673:GOSUB6
1 IFS<>177115THENPRINT:PRINT"CHE
CK-SUM ERROR":PRINT:END
2 SYS680:SYS58648:POKE780,54:POK
E782,228:SYS51998:PRINT"  DFR EX
TENDED BASIC":PRINT
4 PRINTCHR$(157)(PEEK(644)-38)*2
56-1"BYTES FREE":POKE198,0:NEW
6 FORI=0TOA:READA$:FORJ=0TO38:F=
(ASC(A$)-65)*26+ASC(MID$(A$,2))-
65:S=S+P
8 POKEB+I*39+J,P:A$=MID$(A$,3):N
EXT:NEXT:RETURN
200 DATA BGEUHPGEAFHDJRABJGDJHTB
IJGCTHTCNFOCMHTDNGUCIFCGVGGAAFEA
LCEJTJDBGJGATHTEYJGAWHH
201 DATA JDBGJGBNBWADIYIAJMIWALG
IGVGNHSHDJRABIYIAIQGKGVGJALAYEBH
WGBJRABHSIYHDJRABGBJRAB
202 DATA IAJMGIGVHSIAGUHSHDJRABJ
GAGHTBIIAJMJGJHDSAIHTJVJGBQBKAPB
WBMHTHWFOBIBOCEIZHVGOFC
203 DATA CVGEJVHUJGAIHSHDJDBGAQJ
QBWJLHSHDJDBGBWAFBGICJVIAJLCYJFH
QBOCYBAHRGEABGVESHTHWFO
204 DATA AZHTITGUAVCEIZHVAKGMHDH
CBGFDJSHDHBBGFDJRBGGFACEEJRAADSA
HHZDABHAWBIBBBIBEBIBHBI
205 DATA BTBICABICWBIDZBIERBIFEB
IFYBIAUBJCABJFDBJFYBJHFBJHRBJIMB
JITBJJCBJJQBJBABKIEBKCC
206 DATA BLAHHZCZDBCQHPCPCYHMCPC
YIDCPCYHRCNIECVDAHVCNDHIIDICQIFD
IDBHWCPCUCNHYDFDBDHDAHO
207 DATA DFCRIEDEDFCRIECTCPDBHWC
JCNCYIEDHCQHRCPCUCNCVHYDCDHIEDED
CIECVDAIGDHDCIDCQDAIDDC
208 DATA CYCNCPHPCPCUCNICCXCRIJA
AAAAAAAAAAAAAAAAAAAAABGAYIVBGIAA
CHTAAIAABDSHTABIABSGNAA
209 DATA GMFDDJFDDLGNAUFDDKGNEYF
DDMGVDLFPDJHSIAJPIWDMGKDKIYFEDKI
QEGIAJEGNAIBGCOIXGNHXFL
```



Sir, can I have some more.

INV normalises screen.

PLACE k,c,x,y — Puts screen code character k on the screen with colour c at column x and line y. It will accept any multiple of four parameters. It works in all modes but the screen in mode 3 is treated as 20 columns. To get lower case characters in mode 3 use POKE 9329,136 and normal upper case is POKE 9329,128.

UPS x — scrolls screen upwards x times. Don't use in mode 3.

DNS x — scrolls screen down x times. Don't use in mode 3.

■ OTHER COMMANDS.

CLB — clears the keyboard buffer. Poke 198,0. Halt x stops program execution for x 60ths of a second so halt 30 will wait for ½ a second.

CHAIN — ends the program and loads and runs the next program on tape.

PUT x — outputs ascii characters x to the current output device. Can have any number of parameters eg. PUT8,14 locks Vic in lower case.

RPTx — repeat key facility

RPT0 — Normal

RPT64 — No keys repeat

RPT128 — All keys repeat

UDG I,J,K,L,M,N,O,P,Q — creates user defines character I (0-19) where I is in screen code. The remaining eight variables relate to the 8 lines of pixels. To redefine a double height character its screen code number must be multiplied by 2 for the value of I and then redefine two characters.

Program 1.

```
2 POKE648,16:SYS58648:PRINTCHR$(
8)SPC(24)"PLEASE WAIT WHILST"SPC
(31)"LOADING"SPC(60)
4 POKE9728,0:POKE9730,0:POKE43,1
:POKE44,38:POKE45,3:POKE46,38:PO
KE198,1:POKE631,131
```

Only the first 96 double height characters can be redefined.

KEY(x) — is a function and returns a value of either 0 or −1. If key x is down −1 is returned also 0 is returned. The value of x has to be in PEEK(197) key code. This sort of key testing allows multi key input.

IFKEY(X)THEN — tests for key x down.

IFNOTKEY(X)THEN — tests for key x up.

CHAR(x,y) — is a function and returns the screen code of the character at position x and y. Not for use in mode 3. Parameters in commands can be variables. Expressions. Formulae or even numbers.

To enter the program first save program 1 on tape then type in program 2. When it runs without an error message save it after program 1.

All commands can be placed within print statements between semicolons. If a command is entered directly from keyboard a syntax error might result. An extended basic command after a Then statement must be preceeded by a colon, for example:

IFX<160THEN:SETX,Y

KEY CODE TABLE

C	1	2	3	4	5	6	7	x8
C	1	÷	1	#		$	Q	2
1	2	W	A	%	Z	S	E	4
2	5	R	D	X	C	F	T	6
3	7	Y	G	V	B	H	U	8
4	9	I	J	N	M	K	O	0
5	+	P	L	,	'	:	e	—
6	£	%	;	/	&	=	?	'
7	(	)	I	I	f1	f3	f5	f7

: = CTRL # = STOP $ = CBM / = LSHIFT
? = Uparrow ' = HOME (= DEL) = RTN
(= CRSR) = CRSD.
For example key H = 5 × 8 + 3 = 43
CTRL key = 2 × 8 + C = 16

```
210 DATA AFFODSHTACIACTGNAAGMFDD
JFDDLGNAUFDDKGNEYFDDMGVDLFPDJHSF
PDJFGIWDLIAAJGKDMIYIQFE
211 DATA JGAOFEDMGJDJAYEBACFDDJF
OISAYIWDKFOINGNHXFLAFFOGNBFFLADF
OGNAYFLABFOGNAICYCOIXGG
212 DATA JVFIGBJGAPHUIQAPIAJNGNJ
GFDBMGNAGFDBNGNAAGMFPBMIWBMIAJQI
WBNGJBNHTBGIAJFGNAIBGCO
213 DATA IXGNHWFLAFFOGNAOFLAAFOG
NBJFLABFOGNAUFLACFOGNAZFLADFODSG
NAAFDHQDSCYDRIVCYIOBHBG
214 DATA IAACGMBGHXACGOAYCYAKIVB
GIAACFLFEACDSGRAOFOBPAPFDHNBGIAA
CBPAPAKAKAKAKAFHNFLAOFO
215 DATA DSBGIAACAKAKAKAKFDHNBGH
XACBPAHAFHNFDHNGRAPFOBPAIAFHNFLA
PFODSGRAOFOBPJGFDHNBGIA
216 DATA ACBPAPAFHNFLAOFODSBGIAA
CBPADGOBGHXACGEAKFODSBGIAACFLAKF
OGGAABGHXACGBALFOIYIQAD
217 DATA IAJLDSBGIAACFLJUACBGHXA
CFLJVACGNAQFDBNFDBPGRJUACCUCWCWC
WFDBMGRJVACCWCWCWCWAKAK
218 DATA AKAKCUFDDWCWCWAYDXDWDXB
MFDBMGEAAEAFDBQGJDXCEIVBQFDEOGNA
AGGAGAYEJBMFOACIWBPHUIA
219 DATA JMAYDXBOFDBOEABPAHCVAHG
OGNABHUBWAEAKAYFOJPJAJAARBOFPBOG
RJQBIHTJAIAAMGJBNAYEBFC
220 DATA FDBNGRFEACFPBMDSGNCVFLJ
QBIGNJVFLJRBIGNBXFLJSBIBGFYBIGNJ
AFLJQBIFLJRBIGNARFLJSBI
221 DATA DSBGIAACGOGEABGVESHTBSJ
GBEGNFSFDBNGNAAFDBMGGACGEAAGVBMA
YDXDXBPAHFPBMHSIAJKIWBN
222 DATA HUIAJDDSFIFDHNBGHXACGNF
SFDBNGNAAFDBMGGACGEAAGVBMBPAPHPH
NIAAEGJDXFPBMHSIAJHIWBN
223 DATA HUIAJADSBGIAACAYDXGGGOG
JDWDXGFGMIUGGIAJSHOGFIAJODSBGIAA
CCUCWCWCWCWCWAYEBAUFDBN
224 DATA EAAKAKAKFDBMGEAABGHXACF
PBMHSHKAIIAJMDSGNABFDHQGNFBFLEPA
CCYETHOBGIAACBGESJIGEAE
```

(program 2 continued on next page)

(program 2 continued from previous page)

```
225 DATA GVESHTBSIAAGBGHXACAYFOJ
FDSBGIAACFLFIACDSGRAPFOCVAIFLAPF
ODSBGIAACCUBGENIZEAGOHU
226 DATA FIIAJMDSBGIAACCUGJIGCUG
NJVFDIGGNIJFDGCBGJEIZEAFDIGGNFOF
DIJEAGOHUFIIAIUDSEQBGIA
227 DATA ACCUGRAFFOHTHWJGCOBGHXA
CCUGNAQFDGZBGHXACCUBGHXACGOEAIQA
AJGAKAYEBAWFOACIWGZHUIA
228 DATA JMFDGYFDBPGJGZAYEBFCFDB
QGEAAEAFPBPEAFPGYGEABGVESHTBSIAA
GBGEOAAAYFOGZDKDSEACUCW
229 DATA CWCWCWCWAYEBEYFDHOEAAKA
KAKFDHNBGHXACCUBGHXACFDBMGNFSFDB
NBGHXACCWGOGEAAAKHPDXJG
230 DATA ACGEAIFCHJHUBWANGNAUAYD
XBMFDBMFOACIWBNIAJGGEAAEAFPBMGJB
NCEIZFSFDBNGGAEAGBMBMBN
231 DATA HUIAJPGJBMAYDXHJFDBMGNA
RDXBNFDBNGEAHGVHNFPBMFGAQJPCYDKB
KBGJQHYBGGCIHFICUBGJTHY
232 DATA GNAAFDBMGNAQFDGZBGGCIHF
IGGAVAYDXDXFOACIWGZHUIAJMFDGYBGJ
NHYEAGMGVGYGMCYGGIDGNAA
233 DATA FDANBGEOAAHTITFOAUHTIVG
UAQCEIZHVAKGMHDHCBGCUHDHBBGCUCYE
OAAGJESIAACHQETHQESCYFE
234 DATA HYAABGDUBGIUHRAFBLEQBGJ
HHYGRBGFPCUGRBHFPCUBGGOIBGJDXCWC
WCWGOBGEPBLCVJVFLBGFPGJ
235 DATA DXBPAHGOBGEPBLFDEOGRBHF
PCVJVBLBOJGACGNJVGMBGFPIDEAFLBHF
PEAFLBGFPDKDSGNABIQAAJG
236 DATA AEAKHUIAJSDSCCBSAAJVAAJ
VAAJVAAJVAAJVAAJVAAJVAAJVAAJVAAJ
VAAJVAAJVAAJVAAJVAAJVAA
300 DATA IWESIAACIWETDSGGAFHHHUA
CGBELAAHUAQJNGGAHHHBVBLGBAEADHUA
QJNGNAQFLFGACCYAYIVAAAA
301 DATA AAAABGFTBGBGGFACFICUFWC
UBGGFACBGGCIHHTAAIAAMHPGBJGAIGGD
KGBAAACHUAQJQGJESIAACHQ
302 DATA ETHQESEAGMEAGOGJDXDSAAA
AAAAAAAAAAACGHOFBHOEUHPBAHRIUHRF
EHYAAAAAAAAAAAAAAAAHJJA
```

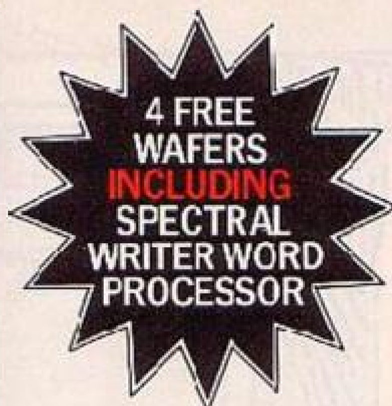
Demo program — Beekeeper.

```
10 GOSUB1000
15 GETK$:IFK$=""GOTO20
17 G=DX:H=DY:DX=(K$="■")-(K$="■"
):DY=(K$="A")-(K$="Z")
18 IFDX=0ANDDY=0THENDX=G:DY=H
20 I=X:X=X+DX:J=Y:Y=Y+DY:IFX<0OR
X>21THENDX=-DX:X=I
25 IFY<2ORY>14THENDY=-DY:Y=J
27 IFCHAR(X,Y)=36GOTO40
28 IFCHAR(X,Y)=35GOTO60
30 PLACE32,0,I,J,37,4,X,Y:GOTO15
40 S=S-1:FORZ=200TO175STEP-1:CHA
N2,Z:NEXT:CHAN2,0:IFS<0THENS=0
45 GOTO70
60 S=S+1:P=P+1:FORZ=225TO250:CHA
N2,Z:NEXT:CHAN2,0
70 PRINT"■"TAB(12)S"■ ":IFP<25GO
TO30
75 SOUND0,0,0,0
80 FORT=1TO20:FORZ=7TO0STEP-1:GC
OL1:VDU0,Z:CHAN2,128+Z-T*5:NEXTZ
,T:SCUND0,0,0,254
82 CLS:PRINTAT0,5"YOUR SCORE IS"
S"/ 25":FORV=15TO0STEP-.05:VOLV:
NEXT
85 INK0:PRINTAT0,8"ANOTHER GO ?
(Y/N)"
90 GCOL4:IFKEY(11)THENRUN
95 IFNOTKEY(28)THEN:HALT10:GOTO9
0
100 MODE0:CLB:END
1000 MODE2:UDG79,254,124,56,254,
130,170,170,170:UDG71,186,186,17
0,170,170,130,254,0
1001 UDG72,36,24,24,36,36,126,12
6,66:UDG73,66,126,126,36,36,24,2
4,36
1002 UDG74,0,126,129,165,165,165
,129,153:UDG75,153,129,129,189,1
53,129,126,0
1003 PRINT"  *** BEEKEEPER ***";
AT0,3;INK4"GET THE HONEY POTS ■#
■  AND AVOID THE ";
1005 PRINT"BEES ■$■.";AT0,6;INK2
"ONCE MOVING YOU CAN'T STOP.":AT
3,9;INK5"A/Z---UP/DOWN"
1010 PRINTAT3,10"CRSR--LEFT/RIGH
T";AT2,13;INK1;"PRESS CTRL TO GO
 !":I=0
1015 GCOLI,1-I:IFNOTKEY(16)THEN:
HALT10:I=1-I:GOTO1015
1020 CLS:VDL0,0:PRINTTAB(6)"■SCO
RE: 0","______________________":
FORI=0TO1:FORJ=1TO25
1025 X=INT(RND(1)*22):Y=INT(RND(
1)*13)+2:IFCHAR(X,Y)<>32OR(X=10A
NDY=7)GOTO1025
1030 PLACE35+I,6+I,X,Y:NEXTJ,I:X
=10:Y=7:DX=0:DY=0:P=0
1040 FORI=128TO254:VOLI/16:SOUND
I,I,I,0:NEXT:SOUND0,0,0,0:CLB:RE
TURN
```

Demo program — Poly organ.

```
10 GOSUB1000
20 X=0:FORI=0TO2:S(I)=0:A$(I)="
 ":NEXT
25 FORI=0TON:IFKEY(K(I))GOTO50
30 NEXT
35 O=12-O:VDU0,7
40 FORI=0TO2:CHANI,S(I):PRINTAT5
+I*5,8A$(I):NEXT:GOTO20
50 S(X)=A(I,X):A$(X)=N$(I):X=X+1
:IFX=3THENX=2
60 GOTO30
1000 MODE0:PUT8:VDU8,7:VOL8:O=8:
N=12:DIMA(N,2),K(N),S(2),N$(N),A
$(2)
1010 FORI=0TO12:FORJ=0TO2:READA(
I,J):NEXT:READK(I),N$(I):NEXT
1020 FORI=1TO8:INK1:FORJ=0TO5:PR
INTAT2+I*2+(I>3)+(I=8),15+J"■ ":
NEXT
1025 IFI<>3ANDI<>7ANDI<>8THENFOR
J=0TO3:INK0:PRINTAT2+I*2+1+(I>3)
,15+J;"■ ":NEXT
1030 NEXT:INK0:PRINTAT5,16;"■S■D
■■G■H■J";INK1;AT4,19;"■Z■X■CV■B■
N■M<"
1040 PRINT"■■** POLYPHONIC ORGAN
 **":INK0:PRINTAT7,4"CHANNEL";AT
5,6"0     1     2":RETURN
2000 DATA223,191,128,33,"C ",225
,195,134,41,"C#",227,198,141,26,
"D ",228,201,147,18,"D#"
2002 DATA230,204,153,34,"E ",231
,207,159,27,"F ",232,210,164,19,
"F#",234,213,170,35,"G "
2005 DATA235,215,174,43,"G#",236
,217,179,28,"A "
2010 DATA237,219,183,20,"A#",238
,221,187,36,"B ",239,223,191,29,
"C "
```

■



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Program 2.

60000	CD2A6471FD365136	=	415
60008	[illegible]	=	785
60016	[illegible]	=	987
60024	[illegible]	=	402
60032	[illegible]	=	373
60040	[illegible]	=	488
60048	[illegible]	=	1022
60056	[illegible]	=	657
60064	[illegible]	=	754
60072	572E4FD73E46D73E	=	868
60080	[illegible]	=	818
60088	[illegible]	=	855
60096	[illegible]	=	1170
60104	[illegible]	=	776
60112	[illegible]	=	752
60120	[illegible]	=	[illegible]
60128	[illegible]	=	919
60136	[illegible]	=	835
60144	[illegible]	=	708
60152	[illegible]	=	621
60160	[illegible]	=	[illegible]
60168	[illegible]	=	[illegible]
60176	[illegible]	=	[illegible]
60184	[illegible]	=	[illegible]
60192	[illegible]	=	964
60200	[illegible]	=	547
60208	[illegible]	=	[illegible]
60216	[illegible]	=	[illegible]
60224	[illegible]	=	[illegible]
60232	[illegible]	=	584
60240	[illegible]	=	453
60248	[illegible]	=	401
60256	[illegible]	=	499
60264	[illegible]	=	1041
60272	[illegible]	=	849
60280	[illegible]	=	795
60288	[illegible]	=	806
60296	[illegible]	=	839
60304	EA2A3E71E5111400	=	711
60312	[illegible]	=	665
60320	[illegible]	=	711
60328	[illegible]	=	1244
60336	[illegible]	=	720
60344	[illegible]	=	816
60352	[illegible]	=	744
60360	0E02EDB0ED533471	=	914
60368	[illegible]	=	1023
60376	[illegible]	=	1036
60384	[illegible]	=	574
60392	[illegible]	=	863
60400	[illegible]	=	763
60408	[illegible]	=	817
60416	[illegible]	=	822
60424	[illegible]	=	1122
60432	[illegible]	=	1090
60440	[illegible]	=	1319
60448	[illegible]	=	1249
60456	[illegible]	=	680
60464	79FE01CA1268E511	=	946
60472	[illegible]	=	528
60480	[illegible]	=	790
60488	[illegible]	=	[illegible]
60496	[illegible]	=	1094
60504	[illegible]	=	1134
60512	[illegible]	=	[illegible]
60520	[illegible]	=	1218
60528	[illegible]	=	466
60536	[illegible]	=	1196
60544	19E5E52A3871A7ED	=	1104
60552	[illegible]	=	[illegible]
60560	[illegible]	=	[illegible]
60568	[illegible]	=	801
60576	[illegible]	=	[illegible]
60584	[illegible]	=	829
60592	[illegible]	=	802
60600	[illegible]	=	1411
60608	[illegible]	=	867
60616	[illegible]	=	[illegible]
60624	[illegible]	=	[illegible]
60632	[illegible]	=	734
60640	[illegible]	=	673
60648	[illegible]	=	1288
60656	[illegible]	=	1110
60664	[illegible]	=	827
60672	[illegible]	=	618
60680	[illegible]	=	[illegible]
60688	[illegible]	=	[illegible]
60696	[illegible]	=	[illegible]
60704	[illegible]	=	861
60712	[illegible]	=	635
60720	[illegible]	=	626
60728	[illegible]	=	604
60736	[illegible]	=	710
60744	[illegible]	=	[illegible]
60752	[illegible]	=	1034
60760	[illegible]	=	1298
60768	[illegible]	=	1201
60776	[illegible]	=	1090
60784	[illegible]	=	829
60792	[illegible]	=	899
60800	[illegible]	=	985
60808	[illegible]	=	959
60816	[illegible]	=	1284
60824	[illegible]	=	250
60832	[illegible]	=	648
60840	[illegible]	=	[illegible]
60848	[illegible]	=	500
60856	[illegible]	=	480
60864	[illegible]	=	790
60872	[illegible]	=	481
60880	2CD1C10E00CD3C22	=	547
60888	[illegible]	=	952
60896	[illegible]	=	[illegible]
60904	[illegible]	=	1048
60912	[illegible]	=	802
60920	[illegible]	=	741
60928	[illegible]	=	1055
60936	[illegible]	=	[illegible]
60944	[illegible]	=	876
60952	[illegible]	=	456
60960	[illegible]	=	[illegible]
60968	[illegible]	=	888
60976	[illegible]	=	[illegible]
60984	[illegible]	=	1359
60992	[illegible]	=	538
61000	[illegible]	=	757
61008	[illegible]	=	[illegible]
61016	[illegible]	=	[illegible]
61024	[illegible]	=	[illegible]
61032	[illegible]	=	937
61040	[illegible]	=	719
61048	[illegible]	=	[illegible]
61056	[illegible]	=	873
61064	[illegible]	=	[illegible]
61072	[illegible]	=	513
61080	[illegible]	=	438
61088	[illegible]	=	574
61096	[illegible]	=	664
61104	[illegible]	=	[illegible]
61112	[illegible]	=	1150
61120	[illegible]	=	[illegible]
61128	[illegible]	=	1116
61136	[illegible]	=	1140
61144	[illegible]	=	[illegible]
61152	[illegible]	=	533
61160	[illegible]	=	825
61168	[illegible]	=	934
61176	[illegible]	=	651
61184	[illegible]	=	[illegible]
61192	[illegible]	=	787
61200	[illegible]	=	616
61208	[illegible]	=	1020
61216	[illegible]	=	918
61224	[illegible]	=	1040
61232	[illegible]	=	974
61240	[illegible]	=	457
61248	[illegible]	=	[illegible]
61256	[illegible]	=	837
61264	[illegible]	=	694
61272	[illegible]	=	914
61280	[illegible]	=	513
61288	[illegible]	=	1009
61296	[illegible]	=	980
61304	[illegible]	=	[illegible]
61312	[illegible]	=	842
61320	[illegible]	=	1050
61328	[illegible]	=	1291
61336	[illegible]	=	832
61344	[illegible]	=	[illegible]
61352	[illegible]	=	847
61360	[illegible]	=	[illegible]
61368	[illegible]	=	807
61376	[illegible]	=	989
61384	[illegible]	=	1095
61392	[illegible]	=	870
61400	[illegible]	=	609
61408	[illegible]	=	887
61416	[illegible]	=	1064
61424	[illegible]	=	[illegible]
61432	[illegible]	=	1228
61440	[illegible]	=	921
61448	[illegible]	=	869
61456	[illegible]	=	919
61464	[illegible]	=	851
61472	[illegible]	=	[illegible]
61480	[illegible]	=	995
61488	[illegible]	=	913
61496	[illegible]	=	655
61504	[illegible]	=	852
61512	19E5E5B06081ABE2	=	754
61520	[illegible]	=	620
61528	[illegible]	=	1219
61536	[illegible]	=	1111
61544	[illegible]	=	1265
61552	[illegible]	=	636
61560	D1E1EED5ED456D71	=	1410
61568	[illegible]	=	1410
61576	[illegible]	=	1081
61584	[illegible]	=	1415
61592	[illegible]	=	886
61600	[illegible]	=	1311
61608	[illegible]	=	1068
61616	[illegible]	=	966
61624	[illegible]	=	715
61632	[illegible]	=	1240
61640	[illegible]	=	869
61648	[illegible]	=	788
61656	[illegible]	=	733
61664	[illegible]	=	470
61672	[illegible]	=	717
61680	[illegible]	=	1046
61688	[illegible]	=	300
61696	[illegible]	=	1052
61704	[illegible]	=	1229
61712	[illegible]	=	[illegible]
61720	[illegible]	=	702
61728	[illegible]	=	1286
61736	[illegible]	=	1326
61744	[illegible]	=	976
61752	[illegible]	=	801
61760	[illegible]	=	845
61768	[illegible]	=	[illegible]
61776	[illegible]	=	1041
61784	[illegible]	=	984
61792	[illegible]	=	978
61800	[illegible]	=	1020
61808	[illegible]	=	801
61816	[illegible]	=	867
61824	[illegible]	=	781
61832	[illegible]	=	914
61840	[illegible]	=	1072
61848	[illegible]	=	1202
61856	[illegible]	=	1403
61864	[illegible]	=	698
61872	[illegible]	=	1181
61880	[illegible]	=	[illegible]
61888	[illegible]	=	[illegible]
61896	[illegible]	=	[illegible]
61904	[illegible]	=	886
61912	[illegible]	=	1034
61920	[illegible]	=	753
61928	[illegible]	=	705
61936	[illegible]	=	[illegible]
61944	[illegible]	=	1208
61952	[illegible]	=	[illegible]
61960	[illegible]	=	361
61968	[illegible]	=	621
61976	[illegible]	=	[illegible]
61984	[illegible]	=	909
61992	[illegible]	=	960
62000	[illegible]	=	[illegible]
62008	[illegible]	=	1107
62016	[illegible]	=	1144
62024	[illegible]	=	1138
62032	[illegible]	=	1063
62040	[illegible]	=	763
62048	[illegible]	=	716
62056	[illegible]	=	[illegible]
62064	[illegible]	=	[illegible]
62072	[illegible]	=	690
62080	[illegible]	=	687
62088	[illegible]	=	534
62096	[illegible]	=	1310
62104	[illegible]	=	860
62112	[illegible]	=	[illegible]
62120	[illegible]	=	[illegible]
62128	[illegible]	=	639
62136	[illegible]	=	[illegible]
62144	[illegible]	=	631
62152	[illegible]	=	1250
62160	[illegible]	=	955
62168	[illegible]	=	[illegible]
62176	[illegible]	=	1129
62184	[illegible]	=	772
62192	[illegible]	=	1001
62200	[illegible]	=	641
62208	[illegible]	=	[illegible]
62216	[illegible]	=	[illegible]
62224	[illegible]	=	807

(continued on page 104)



SPECT

Jon Ellis with a data handler that does away with arrays.

SECURIFILE IS A flexible machine-code data-handling program which illustrates the best of the different approaches to data storage.

Broadly speaking, most database programs for the Spectrum can be divided into three categories according to flexibility.

The first category are those programs designed for specific data, and require modification before the data can be altered. An example is a program I wrote to test all of our computer games and information about them such as their controls. The information was held in data lines, and was read as required.

When a new game needed to be added, the program had to be loaded, altered and then resaved. To alter the program so that it could store data on a subject such as a book collection, a major rewrite would be necessary. To a user who knew nothing about programming, the program would merely provide a fixed set of information with no scope of change.

The second category consists of programs which declare a large array at the beginning, and you input data into the elements of that array. These elements can then be sorted, listed, printed etc. The whole array can be saved on tape and reloaded when required. These programs have the major advantage in that data on any subject can be stored and handled. This means that two users can use the same program skeleton to handle wildly different sets of data.

There are, however, several major disadvantages of this approach: the form of each item is dictated at the beginning of the program by the dimensions of the array; the programs are often written in Basic and their sort routines are therefore slow; there is little scope for cross-referencing etc. When such programs are implemented on the Spectrum, another major disadvantage appears — they waste a lot of space. This is due to the way that the Spectrum handles both string and number arrays.

If there are any unused elements in an array then the Spectrum will fill these with either spaces or zeros as applicable.

This means that if one piece of data is significantly longer than the rest, the array will have to be dimensioned for the longest item, and so space will be wasted at the end of the other items. This bulking out is known as Procrustean assignment and is a prime example of fixed length record storage.

The programs in the third category do away with arrays and their accompanying disadvantages and use a variable length record system. This means that only the data is stored and little space is wasted. These programs are the most flexible, imposing few constraints on the data to be stored. These programs are, however, difficult to write, especially in Basic.

To design a database system we should look at the features we would like it to have. Some of the factors to be taken into consideration are:



'RUM SECURIFILE

- Memory consumption. The program should be as small as possible, maximising space available for the data, which itself should be stored as efficiently as possible.
- As few constraints on the makeup of the file as is possible. The database should be able to handle items of different formats within the same file.
- The program should offer the following basic functions:
  i) The ability to append an item to the file.
  ii) The ability to delete an item from the file.
  iii) The ability to edit an item.
  iv) The ability to store the file on some backup storage — tape, Microdrive
  v) The ability to list the items.
  vi) The ability to sort into alphabetical order.
- A more advanced database program might also provide some extra features such as cross-referencing between items printer compatibility, a choice of storage media, sublist extraction, file security, network communications using the ZX Net.

Bearing in mind all these points, I developed Securifile.

Securifile would be included in category three. It uses a variable-length record storage technique to provide many facilities in a memory-efficient fashion.

Securifile is a reasonably large program as far as typing in goes, 4040 bytes of machine code and data, starting from 25000. This leaves only 2525 bytes available for data on a 16K Spectrum, but a massive 35693 bytes are free on a 48K Spectrum. You need a 48K Spectrum to enter Securifile from the listings, but tape copies will run quite happily on the 16K machine. Tape copies of Securifile are available from the author at 29 Ashridge Drive, Bricket Wood, St. Albans, Herfortshire, AL2 3SR for £3.75.

To enter Securifile from the listing, you should type in and run listing 1. This will prompt you for the bytes from listing 2 which you should enter in the rows, entering the checksum when prompted. The checksum should catch most typing errors. When finished the program will save the object code onto tape. Type New and then enter and run listing 3. This will relocate the code down to 25000.

Type New and enter listing 4. Place a blank tape into the recorder and type

SAVE "SECURIFILE" LINE 10

This program should be verified. Now type

SAVE "SECUR CODE" CODE 25000,4040

and then verify the code block also. Now type

RANDOMIZE USR 25000

and the menu should appear on the screen.

Once you have got a working copy of Securifile you should load it up and then read through this section carefully, trying out any points that you do not follow on the program.

Securifile offers 14 functions from a menu, each of which being accessed by pressing the key indicated in red on the menu. Before going on to the detailed breakdown of each function, some explanation of various features of the program is necessary. These features are not actually functions, merely subroutines which are used by several functions.

The screen editor: This is a major routine used by the add item and change item functions to allow you to input an item to the file. The editor presents you with a screen and a cursor which may be moved around using the keys 5, 6, 7 and 8 with Caps Shift. At the top of the screen there is a space for you to put the key field — KF — of your item, and also a space for the tag field — TF. To move the cursor up to the top line, you will have to place it below one of these spaces and then press up.

Caps Shift 2 will change the state of the Caps Lock, indicated by the bar in the top right corner — green = Caps Lock on, blue = off. Caps Shift 1 will wipe the screen, giving you a blank page. This function is queried. To place a character at the current cursor position, just type the appropriate character. To delete a character, move the cursor to the offending character and type a space over the top. Characters such as | which were previously obtained using extended mode, are now available using symbol shift and the appropriate key — © is symbol shift Q.

The following characters should not be used in either the key field or the tag field, although they may be used freely within the item itself: ©, |, ', [,], ', }, _.

Querying: Drastic instructions are queried by the message "Are you sure? Y/N". Only if you press Y will the instruction be executed, any other key results in the instruction being disregarded.

Program 1.

```
  5 CLEAR 59999
 10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
 20 INPUT "Start: ";s
 30 INPUT "Finish: ";f
 40 FOR n=s TO f STEP 8
 50 LET tot=0: PRINT n;"  ";
 60 INPUT h$: PRINT h$;
 70 LET x=0
 80 FOR b=1 TO LEN h$ STEP 2
 90 LET z=FN h(h$): LET tot=tot
+z
100 POKE n+x,z
110 LET h$=h$(3 TO ): LET x=x+1
120 NEXT b
130 PRINT " = ";: INPUT t: PRIN
T t
140 IF tot<>t THEN PRINT "input
 error - try again": GO TO 50
150 NEXT n
160 SAVE "SEC OBJ 1"CODE 30000,
4040
```

Program 3.

```
 50 CLEAR 24999
 60 FOR F=40000 TO 40011
 70 READ A: POKE F,A
 80 NEXT F
 90 RANDOMIZE USR 40000
100 DATA 1,200,15,17,168,97,33,
96,234,237,176,201
```

Program 4.

```
 50 POKE 23693,71: BORDER 0: CL
EAR 24999
 60 PRINT AT 11,5; INK 0; PAPER
 6;"SECURIFILE is loading"
 70 LOAD "SECUR CODE"CODE 25000
 80 RANDOMIZE USR 25000
```



Input of keyfields etc: There will be many times when Securifile wants a piece of information such as the key field of an item to be deleted, or the filename for a cassette save. At these times you will be prompted to enter the information. The characters that you type will be printed on the screen.

All of this input is in lower case, to obtain capitals you will have to use the Caps Shift key as on a typewriter, there is no Caps Lock. You may use delete — Caps 0 — to correct a mistake. Any spare places should be bulked out with spaces.

Break can be pressed at almost any time, and it will abort the function, returning you to the menu. However, Break should not be pressed while a tape function is in operation,

(continued on next page)

(continued from previous page)

indicated by the flashing blue/red border or the blue/yellow lines. This could result in the corruption of your file.

The report "Tape recovery error" which may occur during the load, save and header reading functions is slightly ambiguous. It may mean either of two things: the program is expecting a header block and has read some other tape block by mistake, or that there has been a genuine tape error.

The menu gives the following functions:

1) Add an item. When you select this function you are presented with a blank screen and the cursor of the screen editor. When you have finished making up your item you should move the cursor to the last character and press Enter. If the key field of the new item is already that of an existing item then the program will present you with a choice of changing the new item's key field — press C — or deleting the old item — Press D.

2) Change an item. Apart from the fact that this function will prompt for a key field, and will then display that item, this is the same as the add item function in operation.

3) Delete an item. This function prompts for a key field of an item, and will delete it from the file if it exists.

4) Extract sublist. This is possibly the most powerful function of Securifile. When you select this function it will prompt for the tag field pattern that quality an item for being part of the sublist. This is best explained by means of an example:

Suppose that your file consists of a mixture of bills for the past three years. The bills are for electricity, gas and water. You have decided that the first character of the tag field on any item will be either E, G or W — depending on the subject of the bill — the second and third characters will indicate the month of receipt of the bill — e.g. May = 05, November = 11 — and the fourth and fifth characters will denote the year e.g. 84. The remaining three characters will be undefined. Now, using this function you could ask for a list of all gas bills by using the search pattern G__________. The __ character indicates that that particular character in the pattern is not significant.

To extract a list of all bills in June, the pattern would be __06__________. All bills in June 1984 would require the pattern __0684______. Note that the pattern of eight __ characters is the equivalent of listing all items. When either the screen is full, or the list is complete, the program will wait for you to press X before continuing.

5) Header catalogue. For security Securifile stores its files on tape using a non-standard format, which is however, quite similar to that used for saving programs on tape — a short header block containing the program filename, followed by a block containing the program proper. This function will read the header blocks created by the Securifile save routine.

It will print the filename of that file on tape, this being the name you must quote in order to load that file, and may also print Locked underneath the filename. This indicates that the password security option is locking that file, and that you will need to know the correct password in order to load the file.

6) Key field sort. This function sorts the list of key fields into alphabetical order.

7) List items. This function lists the key field and tag field of every item in the file, pausing after each screen for you to inspect the list. Press X to continue listing.

8) Printer toggle. This function toggles the printer option between On and Off. If the printer toggle is On then output from the following functions is also dumped to the ZX Printer: Extract sublist, List items, View items.

9) Quit. This function is queried before Securifile and control is returned non destructively to Basic.

10) Recover file from tape. This option allows you to reload a previously saved file from tape. It will prompt for the 10-character filename that the file was saved under. You should use the header catalogue function to find the exact filename if you cannot remember it. The specified header will then be loaded.

If the file is locked you will have to stop the tape and enter the correct 10-letter password before the program will load the rest of the file. Unprotected files will load straight through without stopping.

11) Save file onto tape. This option allows the current file to be saved on tape. It prompts for a 10-character filename under which the file is to be saved. The program then asks if you want to restrict access to the file. If you press "Y" then you will be prompted for a 10-character password which will secure that file. When you have entered this, or if you choose to have an unprotected file, the program will display the message "Ready tape & press any key".

You should set up the recorder and start the tape recording before pressing a key. The file saves in two bursts with about a two second gap between them. The file is saved in a coded form. After saving the program will ask you to rewind the tape and press V when ready, the file will then be verified. A successful verification is indicated by a return to the menu. An unsuccessful verification will display the message "Tape recovery error". Rewind and try again.

12) Tag field sort. This function sorts the items in the file into alphabetical order by their tag fields.

13) View item. This option will prompt for the key field of the item to be displayed, and will show the whole item on the screen if it exists.

14) Wipe file. This option is queried and if executed will wipe the current file, returning the internal pointers to their original positions. ■

(continued from page 102)

```
62232 : DECD958BC02_F270 = 1471
62240 : 010B00ED81200921 = 520
62248 : FD70007EFE002099 = 947
62256 : [illegible] = 886
62264 : DD7E0_07DD7E00C7 = 1125
62272 : 7B07CD95BFC0826B = 1241
62280 : 73CD9568CC7E01FE = 1178
62288 : 002B20DD7E00FE3F = 704
62296 : [illegible] = 596
62304 : 35000DD03401DD7E = 875
62312 : 01FE162013DD35C1 = 604
62320 : [illegible] = 549
62328 : 38E02004FE1638C4 = 874
62336 : [illegible] = 1133
62344 : [illegible] = 776
62352 : DD7E00FE002805CD = 867
62360 : [illegible] = 611
62368 : CD350120CBDC3621 = 802
62376 : [illegible] = 875
62384 : [illegible] = 1046
62392 : 38C612DECD956BCD = 1179
62400 : 7E01FE00288FDD35 = 881
62408 : 01208EDD3401DD7E = 835
62416 : 00FE1730FDFE0F30 = 813
62424 : 03FE0E30F3FE0338 = 797
62432 : 9FDD3501189FCD95 = 965
62440 : [illegible] = 855
62448 : [illegible] = 749
62456 : [illegible] = 745
62464 : 16D7DD7E01D7DD7E = 1117
62472 : [illegible] = 985
62480 : [illegible] = 615
62488 : 00CD0269FDCB30CE = 1175
62496 : [illegible] = 1077
62504 : [illegible] = 793
62512 : 8ACDAA86CDEC69C3 = 1328
62520 : [illegible] = 893
62528 : [illegible] = 282
62536 : 01FF7102C93E18D7 = 791
62544 : DD7E01D7DD7E02D7 = 1125
62552 : [illegible] = 733
62560 : D72E15D7AFD7C9FD = 1357
62568 : 3EE2FFDDE501FE7F = 1223
62576 : [illegible] = 581
62584 : [illegible] = 833
62592 : 3EFF37CD5605DDE1 = 1114
62600 : [illegible] = 646
62608 : [illegible] = 595
62616 : [illegible] = 618
62624 : [illegible] = 598
62632 : [illegible] = 425
62640 : [illegible] = 795
62648 : [illegible] = 739
62656 : 3C3037C916020813 = 397
62664 : [illegible] = 271

62672 : 204849454C442049 = 193
62680 : 4E22555345203A16 = 159
62688 : 0102130012001000 = 56
62696 : 2743272D4360616E = 568
62704 : 6765206E65772C22 = 149
62712 : 2745272D45726173 = 587
62720 : [illegible] = 177
62728 : 1001120110024E6F = 246
62736 : [illegible] = 796
62744 : [illegible] = 722
62752 : [illegible] = 599
62760 : C01301110848463A = 246
62768 : 36000C54483A1600 = 266
62776 : 37110410207F204A = 292
62784 : [illegible] = 375
62792 : [illegible] = 31
62800 : C113011002417265 = 318
62808 : [illegible] = 759
62816 : E5203F2020592F4E = 182
62824 : [illegible] = 116
62832 : [illegible] = 54
62840 : 4E6F207375636820 = 588
62848 : 6B6579206669656C = 777
62856 : [illegible] = 175
62864 : [illegible] = 727
62872 : [illegible] = 691
62880 : [illegible] = 438
62888 : [illegible] = [illegible]
62896 : [illegible] = [illegible]
62904 : [illegible] = 182
62912 : [illegible] = 328
62920 : [illegible] = 312
62928 : [illegible] = 192
62936 : [illegible] = 116
62944 : [illegible] = 526
62952 : [illegible] = [illegible]
62960 : [illegible] = 559
62968 : [illegible] = 782
62976 : [illegible] = 541
62984 : [illegible] = 756
62992 : [illegible] = 807
63000 : [illegible] = 653
63008 : [illegible] = 11
63016 : [illegible] = 561
63024 : [illegible] = 556
63032 : [illegible] = [illegible]
63040 : [illegible] = 779
63048 : [illegible] = 574
63056 : [illegible] = 548
63064 : [illegible] = 695
63072 : [illegible] = 780
63080 : [illegible] = 530
63088 : [illegible] = 767
63096 : [illegible] = [illegible]
63104 : [illegible] = 745
63112 : [illegible] = 626
63120 : [illegible] = 567

63128 : [illegible] = 555
63136 : 652066696C651611 = 588
63144 : [illegible] = 483
63152 : [illegible] = 745
63160 : [illegible] = 403
63168 : [illegible] = 648
63176 : [illegible] = 261
63184 : [illegible] = 567
63192 : [illegible] = 643
63200 : [illegible] = 172
63208 : [illegible] = 372
63216 : [illegible] = 621
63224 : [illegible] = 82
63232 : 100748163A110713 = 289
63240 : [illegible] = 72
63248 : [illegible] = 262
63256 : [illegible] = 141
63264 : [illegible] = 633
63272 : [illegible] = 703
63280 : [illegible] = 575
63288 : [illegible] = 560
63296 : [illegible] = 691
63304 : [illegible] = 545
63312 : [illegible] = 701
63320 : [illegible] = 213
63328 : [illegible] = 613
63336 : [illegible] = 238
63344 : 7065207265636F72 = 758
63352 : [illegible] = 808
63360 : [illegible] = 174
63368 : [illegible] = 749
63376 : [illegible] = 780
63384 : [illegible] = 699
63392 : [illegible] = 610
63400 : [illegible] = 67
63408 : [illegible] = 652
63416 : [illegible] = 758
63424 : [illegible] = 721
63432 : [illegible] = 102
63440 : [illegible] = 113
63448 : [illegible] = 431
63456 : [illegible] = 772
63464 : [illegible] = 815
63472 : [illegible] = 231
63480 : [illegible] = 234
63488 : [illegible] = 775
63496 : [illegible] = 653
63504 : [illegible] = 721
63512 : [illegible] = 95
63520 : [illegible] = 653
63528 : [illegible] = 777
63536 : [illegible] = 655
63544 : [illegible] = 431
63552 : [illegible] = 483
63560 : [illegible] = 71
63568 : [illegible] = 749
63576 : [illegible] = 763

63584 : 6622644174612062 = 674
63592 : [illegible] = 716
63600 : 6265206C6F616465 = 748
63608 : 643A130110021709 = 226
63616 : [illegible] = 141
63624 : [illegible] = 532
63632 : [illegible] = 333
63640 : [illegible] = 452
63648 : 2066696C65206973 = 700
63656 : [illegible] = [illegible]
63664 : [illegible] = 750
63672 : [illegible] = 472
63680 : 7220746865207061 = 708
63688 : 7373776F72643A13 = 751
63696 : [illegible] = 62
63704 : [illegible] = 334
63712 : [illegible] = 561
63720 : [illegible] = 643
63728 : 727920616761696E = 779
63736 : [illegible] = 73
63744 : 0800170020 4F7665 = 365
63752 : [illegible] = 789
63760 : [illegible] = 788
63768 : [illegible] = [illegible]
63776 : [illegible] = [illegible]
63784 : [illegible] = 452
63792 : [illegible] = 771
63800 : [illegible] = 611
63808 : [illegible] = 71
63816 : [illegible] = 586
63824 : [illegible] = 423
63832 : [illegible] = 78
63840 : [illegible] = 659
63848 : [illegible] = 748
63856 : [illegible] = 788
63864 : [illegible] = 677
63872 : [illegible] = 728
63880 : [illegible] = 793
63888 : [illegible] = 342
63896 : [illegible] = 599
63904 : [illegible] = 735
63912 : [illegible] = 1178
63920 : [illegible] = 1380
63928 : [illegible] = 560
63936 : [illegible] = 572
63944 : [illegible] = 584
63952 : [illegible] = 567
63960 : [illegible] = 733
63968 : [illegible] = 890
63976 : [illegible] = 865
63984 : [illegible] = 261
63992 : [illegible] = 420
64000 : [illegible] = 420
64008 : [illegible] = 428
64016 : [illegible] = 555
64024 : [illegible] = 403
64032 : 0100000C = 1
```

DISC OVERLAYS

P Andrews squeezes more into the BBC.

THE BBC COMPUTER is a sophisticated machine with many facilities including an excellent Basic interpreter which sets it apart from most other home computers. The main limitation of the machine is the restriction of having only 32K of Ram. Cassette-based machines have about 27K bytes available to Basic when using Mode 7, but disc-based machines have only 25K because the Disc Filing System — DFS — claims about 2.75K for workspace. Using any other screen mode reduces this even further.

Very little can be done to help the cassette-based owner, but it is possible for a BBC computer with disc drive to run a Basic program whose size is limited only by the capacity of the floppy disc being used and the skill of the programmer. The way to achieve this apparently impossible task is to split the program into a number of separate modules — which every programmer should do anyway — and store them on a floppy disc.

The separate modules are only loaded into memory when required and so the modules not being used do not occupy any store Ram. An area of Ram is set aside for the program modules to occupy when they are called and loaded from disc. This area is known as the overlay area, and the modules to be loaded from disc to this area are known as overlay modules. The term overlay is used because when a module is called it is "overlaid" onto the overlay area overwriting any module previously called.

Because modules will overwrite each other a control section is required to ensure that overlay modules are loaded whenever they are required. A routine called the overlay handler is used to control the loading of overlay modules.

As well as the overlay handler a section of code will always be present in Ram. This constitutes the main program and will contain the main body of the program and any routines which are frequently called. It is unwise — unless absolutely necessary — to put frequently called routines into an overlay since the program will be slowed down by the routine being loaded from disc many times over.

Figure 1 shows the memory map for a typical Basic program. Figure 2 shows the memory map for an overlaid Basic program. Since Lomem indicates to the interpreter where all identifiers are to be stored then the overlay area can be created by moving Lomem to make room for the overlay modules to be

Region	Address
ROM	&FFFF
	&8000
SCREEN	
	HIMEM
VARIABLES	LOMEM
	TOP
BASIC PROGRAM	&1900 PAGE
WORKSPACE	&0000

Figure 1. Memory map for a typical Basic program.



Region	Address
ROM	&FFFF
	&8000
SCREEN	
	HIMEM
VARIABLES	LOMEM
OVERLAY AREA	
	TOP
BASIC PROGRAM	&1900 PAGE
WORKSPACE	&0000

Figure 2. Memory map for an overlaid Basic program.

Listing 1.

```
10REM BBC Overlay Handler Demonstration
20REM by P. Andrews Apr 1 1984.
30IF PAGE<>&1900 THEN PAGE=&1900:CHAIN"ROOT"
40ON ERROR MODE 7:REPORT:PRINT " AT ";ERL:END
50*OPT 1,0
60:
70REM set up size of overlay area.
80:
90SZ%=1200
100:
110REM set up pointer to start of overlay area.
120:
130OS%=LOMEM-2
140:
150REM reserve space for overlay area.
160:
170LOMEM=LOMEM+SZ%
180:
190PROCinitialise_overlay_handler
200:
210MODE 4
220:
230PROCscreen_display
240:
250PROCwindow(0,31,39,26,0,3,TRUE
260:
270PROCroot_routine
280:
290PRINT £1100
300VDU7:PRINT "--End of demonstration--"
310PRINT "(use CHAIN not RUN to try again)."
320STOP
330:
340REM-------------------------------
350REM Root Procedure Definitions.
360REM-------------------------------
370DEF PROCscreen_display
380VDU 19,0,4;0;
390PROCrectangle(750 300,800,350)
400PROCrectangle(750 600,300,700)
410PROCrectangle(750 300,1,700)
420PROCrectangle(100 600,250,1)
430PROCrectangle(400 600,250,1)
440PROCrectangle(32,495,1,400)
450PROCrectangle(0,975,1,400)
460PROCellipse(0,-PI,250,600)
470PROCellipse(2*PI,0,250,850)
480PRINT TAB(0,0)"Max overlay nest"
490PRINT TAB(10,0)"0"
500PRINT TAB(24,2);"Variables"
510PRINT TAB(26,18)"Root"
520PRINT TAB(38,12)"D"
530PRINT TAB(35,11)"&";~TOP
540PRINT TAB(35,20)"&";~PAGE
550PRINT TAB(35,21)"PAGE"
560PRINT TAB(35,1)"&";~LOMEM
570PRINT TAB(35,2)"LOMEM"
580PRINT TAB(1,15)"Overlay nesting"
590PRINT TAB(5,5)"Disc"
600PRINT TAB(4,0)"OVER1";TAB(4,10)"OVER2"
610f100$=CHR$(17)+CHR$(1)+CHR$(17)+CHR$(128)
620f0b1$=CHR$(17)+CHR$(0)+CHR$(17)+CHR$(129)
630ENDPROC
640REM-------------------------------
650DEFPROCellipse(start,end,x,y)
660LOCAL step,angle
670MOVE x+150,y
680step=(end-start)/30
690FOR angle=start TO end STEP step
700DRAW x+150*COS(angle),y+45*SIN(angle)
710NEXT
720ENDPROC
730REM-------------------------------
740DEFPROCrectangle(x,y,height,width)
750MOVE x,y
760DRAW x+width,y
770DRAW x+width,y+height
780DRAW x,y+height
790DRAW x,y
800ENDPROC
810REM-------------------------------
820DEFPROCmovestring(x1,x2,y,s$)
830LOCAL x,step
840PROCwindow(x2-1,10,x2+7,6,1,0,TRUE)
850x1=x1*32:x2=x2*32:y=1023-y*32
860VDU5
870GCOL 0,1
880MOVE x1,y:PRINT s$
890FOR x=x1 TO x2-32 STEP 32
900TIME=0:REPEAT UNTIL TIME>5
910GCOL 3,1
920MOVE x,y
930PRINT s$:MOVE x+32,y:GCOL 0,1:PRINT s$
940NEXT
950MOVE x1,y:PRINT s$
960PROCrectangle(400,600,250,1)
970PROCrectangle(750,300,800,350)
980GCOL 0,1
990VDU4
1000ENDPROC
1010REM-------------------------------
1020DEF PROCroot_routine
1030LOCAL reply$,overlay_number
1040PRINT 'f1b0$;" Root ";f0b1$
1050REPEAT
1060REPEAT
1070PRINT "Type :-"
1080PRINT "RETURN to exit this demonstration, or"
1090PRINT "1A,1B or 2A to enter another routine"
1100INPUT reply$
1110UNTIL reply$="1A" OR reply$="1B" OR reply$="2A" O
R reply$=""
1120IF reply$="" THEN 1170
1130overlay_number=EVAL(MID$(reply$,1,1))
1140PROCo("routine"+reply$+"(""ROOT"")",overlay_numbe
r)
1150PRINT 'f1b0$;" Root ";f0b1$;
1160PRINT " return from overlay call"
1170UNTIL reply$=""
1180ENDPROC
1190REM-------------------------------
1200DEFPROCwindow(x1,y1,x2,y2,f,b,clear_flag)
1210VDU 28,x1,y1,x2,y2
1220COLOUR f
1230COLOUR b+128
1240IF clear_flag THEN CLS
1250ENDPROC
1260REM-------------------------------
1270REM Overlay handler routines
1280REM-------------------------------
1290DEFPROCinitialise_overlay_handler
1300max_nest=8:root=255:this_ov=255:max_depth=0
1310DIM oscstr 15,ov_nest max_nest
1320ov_idx=0:ov_nest?0=root
1330ENDPROC
1340REM-------------------------------
1350DEFFNov(str%,ov_call$,ov_no)
1360REM routine to load overlay.
1370LOCAL ret,ret$
1380IF ov_idx>=max_nest THEN VDU 7,7,7:GOTO 1610
1390IF ov_no<0 OR ov_no>255 THEN PRINT "illegal overl
ay":STOP
1400ov_idx=ov_idx+1
1410IF ov_idx>max_depth THEN max_depth=ov_idx
1420PROCwindow(18,0,19,0,1,0,TRUE)
1430PRINT ;max_depth
1440ov_nest?ov_idx=ov_no
1450IF this_ov=ov_no THEN 1500
1460REM the overlay must be loaded into store.
1470PROCmovestring(4,25,6+2*ov_no,"OVER"+STR$(ov_no))
1480PROCosc_command("LOAD over"+STR$(ov_no)+" "+STR$~
(OS%))
1490this_ov=ov_no
1500PROCwindow(1,26,22,16,1,0,FALSE)
1510PRINT TAB(0,ov_idx)ov_call$
1520PROCwindow(0,31,39,26,0,1,TRUE)
1530IF str% THEN ret$=EVAL("FN"+ov_call$) ELSE ret=EV
AL("FN"+ov_call$)
1540PROCwindow(1,26,22,16+ov_idx,1,0,TRUE)
1550ov_idx=ov_idx-1
1560REM need to load overlay?
1570IF ov_nest?ov_idx=this_ov THEN 1630
1580this_ov=ov_nest?(ov_idx)
1590IF this_ov=root THEN this_ov=ov_nest?(ov_idx+1):G
OTO1630:REM return to root.
1600REM need to load previous overlay.
1610PROCmovestring(4,25,6+2*this_ov,"OVER"+STR$(this_
ov))
1620PROCosc_command("LOAD over"+STR$(this_ov)+" "+STR
$~(OS%))
1630PROCwindow(0,31,39,26,0,1,TRUE)
1640IF str% THEN =ret$ ELSE =ret
1650REM-------------------------------
1660DEF FNo(ov_call$,ov_no)
1670=FNov(FALSE,ov_call$,ov_no)
1680REM-------------------------------
1690DEF FNSo(ov_call$,ov_no)
1700=FNov(TRUE,ov_call$,ov_no)
1710REM-------------------------------
1720DEFPROCo(ov_call$,ov_no)
1730LOCAL t
1740t=FNov(FALSE,ov_call$,ov_no)
1750ENDPROC
1760REM-------------------------------
1770DEFPROCosc_command(command$)
1780REM Proc. to achieve *LOAD
1790$oscstr = command$
1800X%=oscstr MOD 256
1810Y%=oscstr DIV 256
1820CALL &FFF7
1830ENDPROC
1840REM----End of Root---------------
>
```

loaded from disc. Although the overlay scheme can save the space occupied by a Basic program it cannot easily be used to save the space used by variables.

Each overlay module may contain several separate routines. To use any of the routines the overlay module in which they are contained must be present in store. If the module must be continually loaded this will be slow; conversely if already loaded then access will be fast. The program will run faster if those routines which are called in sequence are put into the same module wherever possible.

In BBC Basic two types of overlay routine are possible — functions and procedures. The overlay handler must intercept function and procedure calls to overlay routines in order to ensure that the correct module is loaded. Also the handler must know which overlay module contains the routine being called.

To ensure that the modules are loaded correctly all overlay routines must be accessed via the overlay handler. The handler calls the routines once loaded by using the Eval function. To make this possible the call to an overlay routine is made by calling the handler with a string as a parameter containing a call to the routine. A second parameter gives the number of the module within which the routine is stored. Overlay modules are numbered sequentially starting from one and are kept on disc as a series of Basic files Over1, Over2 and so on.

Three separate routines are provided to allow overlay routines to be called. Each routine ensures that the correct overlay module is present in store before the overlay routine is actually called. The string parameter containing the routine call need not normally contain the FN or Proc keywords.

For procedures use: PROCo ("the text of procedure call" overlay module number). For example:

PROCo ("initialise routine", 1)

For numerical functions use FNo ("text of function call", overlay module number). For example:

LET sum = FNo ("difference(a−6)",2)

For string functions use FNs ("text of function call", overlay module number). For example:

LET x$ = x$ + FNs ("string function (" "BBC" ")",2)

Because the handler calls the overlay routines using Eval it is not possible to code procedures in the normal way. Where an overlay routine is used as a procedure then "Def Proc" should be replaced by "Def FN" and "Endproc" should be replaced by "=0".

Any parameters can be passed to the overlay routines but care is required for string constants. Because a string constant uses quotes any string parameter passed to the overlay routine must have the quote characters put in pairs otherwise they will be taken as being the end of the string. For example a string function normally called using 'FNroutine("string")' when not using overlays might be called using the overlay manager as 'FNSo("routine("" "string" "")",1'.

Most overlay routine calls involve only a single function and so rather than supply the "FN" keyword as the first characters in the parameter string the overlay manager will insert these before calling the Eval function. This saves two bytes per call. If a second function is to be called at the same time then the FN keywords must be added to the function name. If the function is overlaid a nested call to the overlay handler is necessary. For example function funa exists in overlay 1 and function funb exists in overlay 2; func and fund are in the Root. An overlaid function call with both functions could be made with:

10 LET x = func + FNo("funa + 2*FNo (" "funb" ",2) + FNfund",1)

Listing 1 contains a demonstration root and overlay handler. Listings 2 and 3 contain the code for overlay modules 1 and 2. Type in each listing and save each program as "Root", "Over1" and "Over2" repsectively. The demonstration shows on the screen the loading of overlay modules from disc and the nested calls being processed. To run the demonstration type Chain "Root".

Examine the demonstration listing. When you are familiar with its operation you can use listing 4 which is the overlay handler to be incorporated in your own programs. The handler in the demonstration should not be

(continued on next page)

Listing 2.

```
5000REM=====================
5010REM Overlay area 1.
5020REM  -routine1A
5030REM  -routine1B
5040REM=====================
5050DEF FNroutine1A(s$)
5060LOCAL reply$, overlay_number
5070PRINT 'f1b0$;" 1A ";f0b1$;" called from ";f1b0$;s
$;f0b1$
5080REPEAT
5090REPEAT
5100PRINT "Type :-"
5110PRINT "RETURN to exit this overlay routine, or"
5120PRINT "1A,1B or 2A to enter another routine"
5130INPUT reply$
5140UNTIL reply$="1A" OR reply$="1B" OR reply$="2A" O
R reply$=""
5150IF reply$="" THEN 5190
5160overlay_number=EVAL(MID$(reply$,1,1))
5170PROCo("routine"+reply$+"(""routine1A"")",overlay_
number)
5180PRINT f1b0$;" 1A ";f0b1$;" return from overlay ca
ll"
5190UNTIL reply$=""
5200REM exit from overlay routine
5210=0
5220REM=====================
5230DEF FNroutine1B(s$)
5240LOCAL reply$, overlay_number
5250PRINT 'f1b0$;" 1B ";f0b1$;" called from ";f1b0$;s
$;f0b1$
5260REPEAT
5270REPEAT
5280PRINT "Type :-"
5290PRINT "RETURN to exit this overlay routine, or"
5300PRINT "1A,1B or 2A to enter another routine"
5310INPUT reply$
5320UNTIL reply$="1A" OR reply$="1B" OR reply$="2A" O
R reply$=""
5330IF reply$="" THEN 5370
5340overlay_number=EVAL(MID$(reply$,1,1))
5350PROCo("routine"+reply$+"(""routine1B"")",overlay_
number)
5360PRINT f1b0$;" 1B ";f0b1$;" return from overlay ca
ll"
5370UNTIL reply$=""
5380REM exit from overlay routine
5390=0
5400REM====End of Overlay area 1
```

Listing 3.

```
5000REM=====================
5010REM Overlay area 2.
5020REM  -routine2A
5030REM---------------------
5040DEF FNroutine2A(s$)
5050LOCAL reply$,overlay_number
5060PRINT 'f1b0$;" 2A ";f0b1$;" called from ";f1b0$;s
$;f0b1$
5070REPEAT
5080REPEAT
5090PRINT "Type :-"
5100PRINT "RETURN to exit this overlay routine, or"
5110PRINT "1A,1B or 2A to enter another routine"
5120INPUT reply$
5130UNTIL reply$="1A" OR reply$="1B" OR reply$="2A" O
R reply$=""
5140IF reply$="" THEN 5180
5150overlay_number=EVAL(MID$(reply$,1,1))
5160PROCo("routine"+reply$+"(""routine2A"")",overlay_
number)
5170PRINT f1b0$;" 2A ";f0b1$;" return from overlay ca
ll"
5180UNTIL reply$=""
5190REM exit from overlay routine
5200=0
5210REM====End of Overlay area 2
>
```

Listing 4.

```
10REM BBC Overlay Handler Demonstration
20REM by P. Andrews April 1984.
30IF PAGE<>&1900 THEN PAGE=&1900:CHAIN"ROOT"
40ON ERROR MODE 7:REPORT:PRINT " AT ";ERL:END
50*OPT 1,0
60:
70REM set up size of overlay area.
80:
90S%=1200
100:
110REM set up pointer to start of overlay area.
120:
130O%=LOMEM-2
140:
150REM reserve space for overlay area.
160:
170LOMEM=LOMEM+O%
180:
190PROCinitialise_overlay_handler
200:
210MODE 4
220:
230PROCscreen_display
240:
250PROCwindow(0,31,39,26,0,3,TRUE)
260:
270PROCroot_routine
280:
290PRINT f1b0$
300VDU7:PRINT "--End of demonstration--"
310PRINT "(use CHAIN not RUN to try again)."
320STOP
330:
340REM===========================
350REM Root Procedure Definitions.
360REM===========================
370DEF PROCscreen_display
380VDU 19,0,4;0;
390PROCrectangle(750,300,800,350)
400PROCrectangle(750,600,300,700)
410PROCrectangle(750,300,1,700)
420PROCrectangle(100,600,250,1)
430PROCrectangle(400,600,250,1)
440PROCrectangle(32,495,1,480)
```

(listing 4 continued on next page)

(listing 4 continued from previous page)

```
450PROCrectangle(0,975,1,608)
460PROCellipse(0,-PI,250,600)
470PROCellipse(2*PI,0,250,650)
480PRINT TAB(0,0)"Max overlay nest"
490PRINT TAB(18,0)"0"
500PRINT TAB(24,2);"Variables"
510PRINT TAB(26,18)"Root"
520PRINT TAB(35,12)"TOP"
530PRINT TAB(35,11)"&";~TOP
540PRINT TAB(35,20)"&";~PAGE
550PRINT TAB(35,21)"PAGE"
560PRINT TAB(35,1)"&";~LOMEM
570PRINT TAB(35,2)"LOMEM"
580PRINT TAB(1,15)"Overlay nesting"
590PRINT TAB(5,5)"Disc"
600PRINT TAB(4,8)"OVER1";TAB(4,10)"OVER2"
610f1b0$=CHR$(17)+CHR$(1)+CHR$(17)+CHR$(128)
620f0b1$=CHR$(17)+CHR$(0)+CHR$(17)+CHR$(129)
630ENDPROC
640REM============================
650DEFPROCellipse(start,end,x,y)
660LOCAL step,angle
670MOVE x+150,y
680step=(end-start)/32
690FOR angle=start TO end STEP step
700DRAW x+150*COS(angle),y+45*SIN(angle)
710NEXT
720ENDPROC
730REM============================
740DEFPROCrectangle(x,y,height,width)
750MOVE x,y
760DRAW x+width,y
770DRAW x+width,y+height
780DRAW x,y+height
790DRAW x,y
800ENDPROC
810REM============================
820DEFPROCmovestring(x1,x2,y,s$)
830LOCAL x,step
840PROCwindow(x2-1,10,x2+7,6,1,0,TRUE)
850x1=x1*32:x2=x2*32:y=1023-y*32
860VDU5
870GCOL 0,1
880MOVE x1,y:PRINT s$
890FOR x=x1 TO x2-32 STEP 32
900TIME=0:REPEAT UNTIL TIME>5
910GCOL 3,1
920MOVE x,y
930PRINT s$:MOVE x+32,y:GCOL 0,1:PRINT s$
940NEXT
950MOVE x1,y:PRINT s$
960PROCrectangle(400,600,250,1)
970PROCrectangle(750,300,800,350)
980GCOL 0,1
990VDU4
1000ENDPROC
1010REM============================
1020DEF PROCroot routine
1030LOCAL reply$,overlay_number
1040PRINT 'f1b0$;" Root ";f0b1$
1050REPEAT
1060REPEAT
1070PRINT "Type :-"
1080PRINT "RETURN to exit this demonstration, or"
1090PRINT "1A,1B or 2A to enter another routine"
1100INPUT reply$
1110UNTIL reply$="1A" OR reply$="1B" OR reply$="2A" O
R reply$=""
1120IF reply$="" THEN 1170
1130overlay_number=EVAL(MID$(reply$,1,1))
1140PROCo("routine"+reply$+"(""ROOT"")",overlay_numbe
r)
1150PRINT f1b0$;" Root ";f0b1$;
1160PRINT " return from overlay call"
1170UNTIL reply$=""
1180ENDPROC
1190REM============================
1200DEFPROCwindow(x1,y1,x2,y2,f,b,clear_flag)
1210VDU 28,x1,y1,x2,y2
1220COLOUR f
1230COLOUR b+128
1240IF clear_flag THEN CLS
1250ENDPROC
1260REM============================
1270REM Overlay handler routines
1280REM============================
1290DEFPROCinitialise_overlay_handler
1300max_nest=8:root=255:this_ov=255:max_depth=0
1310DIM oscstr 15,ov_nest max_nest
1320ov_idx=0:ov_nest?0=root
1330ENDPROC
1340REM============================
1350DEFFNom(str%,ov_call$,ov_no)
1360REM routine to Load overlay.
1370LOCAL ret,ret$
1380IF ov_idx>=max_nest THEN VDU 7,7,7:GOTO 1640
1390IF ov_no<0 OR ov_no>255 THEN PRINT "illegal overl
ay":STOP
1400ov_idx=ov_idx+1
1410IF ov_idx>max_depth THEN max_depth=ov_idx
1420PROCwindow(18,0,19,0,1,0,TRUE)
1430PRINT ;max_depth;
1440ov_nest?ov_idx=ov_no
1450IF this_ov=ov_no THEN 1500
1460REM the overlay must be loaded into store.
1470PROCmovestring(4,25,6+2*ov_no,"OVER"+STR$(ov_no))
1480PROCosc_command("LOAD over"+STR$(ov_no)+" "+STR$~
(O%))
1490this_ov=ov_no
1500PROCwindow(1,26,22,16,1,0,FALSE)
1510PRINT TAB(0,ov_idx)ov_call$
1520PROCwindow(0,31,39,26,0,1,TRUE)
1530IF str% THEN ret$=EVAL("FN"+ov_call$) ELSE ret=EV
AL("FN"+ov_call$)
1540PROCwindow(1,26,22,16+ov_idx,1,0,TRUE)
1550ov_idx=ov_idx-1
1560REM need to load overlay?
1570IF ov_nest?ov_idx=this_ov THEN 1630
1580this_ov=ov_nest?(ov_idx)
1590IF this_ov=root THEN this_ov=ov_nest?(ov_idx+1):G
OTO1630:REM return to root.
1600REM need to load previous overlay.
1610PROCmovestring(4,25,6+2*this_ov,"OVER"+STR$(this_
ov))
1620PROCosc_command("LOAD over"+STR$(this_ov)+" "+STR
$~(O%))
1630PROCwindow(0,31,39,26,0,1,TRUE)
1640IF str% THEN =ret$ ELSE =ret
1650REM============================
1660DEFFNo(ov_call$,ov_no)
1670=FNom(FALSE,ov_call$,ov_no)
1680REM============================
1690DEFFNSo(ov_call$,ov_no)
1700=FNom(TRUE,ov_call$,ov_no)
1710REM============================
1720DEFPROCo(ov_call$,ov_no)
1730LOCAL t
1740t=FNom(FALSE,ov_call$,ov_no)
1750ENDPROC
1760REM============================
1770DEFPROCosc_command(command$)
1780REM Proc. to achieve *LOAD
1790$oscstr = command$
1800X%=oscstr MOD 256
1810Y%=oscstr DIV 256
1820CALL &FFF7
1830ENDPROC
1840REM====End of Root=============
```

(continued from previous previous)

used since it has been modified.

In the demonstration listing the size of the overlay area is specified. *Info should be used to determine the size of the overlay files produced. For example:

e.g. *INFO OVER1
OVER1 1900 801F 2000 A7

The size of Over1 is &2000 bytes so the overlay area must be at least this big for the overlay to fit. The total size of the program will be:

program size = TOP − PAGE + overlay size − 2

When choosing line numbers, the root must have the lower line numbers and the overlay routine the higher numbers. No overlay module can contain the same range of numbers as the root, but separate overlay modules can share the same range.

Care must be taken when correcting errors. If the root is changed after an overlay is loaded and then Saved it will be too big because both root and overlay will have been saved. Always load the root or relevant overlay before making alterations.

Obscure errors can arise if the overlays are called incorrectly. Two errors can cause great confusion — clashing line numbers between the root and overlay modules and also two routines with the same name occurring in different overlay modules. ■





THE INVISIE TOO

Stuart Clarke presents a number of machine-code routines for the ZX-81 which are driven by a short Basic menu.

THE INVISIBLE TOOLKIT is a suite of fast efficient machine-code routines driven by a short Basic menu. Due to the fact that extensive use is made of routines already present in the Rom the machine-code is written in less than 800 bytes, which together with the Basic lines occupies less than 1800 bytes of memory.

The program was written to make it easier to modify and develop a Basic program and even combine two or more Basic programs — or routines — so that the idea of having a library of useful subroutines on cassette is quite feasible. In addition, the facility to create large Rems, or delete them at a stroke, is invaluable when assembling machine-code.

The following routines are available:

DOWN CODE — used after Up Code. Downloads the copy in upper memory into a specified line and Address. Space is automatically created.

DOWN BASIC — used after Up Basic. Brings the Basic copy down into the Basic area placing it according to the first line number of the block.

LINE ADDRESS — gives the address of the specified line number. The first character is four bytes further on.

REM EXPAND — expands the Rem statement with the specified line number, from a specified address, by a given number of bytes.

UP CODE — copies a given number of bytes from a given address, into upper memory.

UP BASIC — copies a block of Basic lines specified by first and last lines.

BLOCK DELETE — specify first and last lines.

RENUMBER BASIC — renumbers a block of Basic lines specified by first and last lines. You are allowed to specify both the Increment and the New first line number. All non-computed Gotos, Gosubs, and Runs will be correctly changed, provided the line number is in four-digit form, e.g., Goto 1 as Goto 0001.

RENUMBER COPY — used after Up Basic. Only requires the Increment and New first line number to be specified.

The order in which the routines are listed may seem a little odd, but this is as they appear in the menu. This is dictated by the use of relative rather than absolute jumps in the machine-code to allow it to be position independent, and the entire program has been written in such a way that, as well as the machine code, the Basic menu can be transferred to upper memory — without over-writing existing upper memory contents — to allow the Loading of subsequent programs.

When required, the menu can be recalled, and it will not clash with the existing Basic as its lines are numbered A222 to A239 — 10222 to 10239. This is possible since the Rom checks the validity of a line number by only comparing the high byte with 40 decimal — 40 times 256 equals 10240, the first "non-valid" line number.

However, line numbers in the range 10000 to 11239 are only obtained by using the Renumber routine, as 9999 is the largest line you can enter direct from the keyboard. The menu lines are now tagged on to the end of the program you have just Loaded.

Report codes.

K/A234	you have attempted to use Down Code when no copy exists in upper memory.
T/A233	you have attempted to use Down Basic or Renumber Basic when the "live" copy is not Basic.

System variables.

16388-16389	Ramtop
16507-16508	Old Ramtop
16444-16451	Poked by menu
ZX81	variable pointing to the first location in the "jump table" accessing the machine-code routines.

If the typing seems a bit of a chore, just send your name and address with a cheque for £3 made payable to Sarglen Software, to 147



BLE

LKIT

South Parks Road, Glenrothes, Fife, KY6 1NT, and I will send you a quality cassette with two copies each for machines with and without the "improved Rom", together with an instruction leaflet.

Type in program 1, then duplicate line 1 using the Edit key so that you have 12 identical lines, numbered 1 to 12. Now Run program 1.

Type in program 2, and Run it. This is the hex loader. Enter the address 16544 — or the appropriate address if you are resuming after a break — and enter the hex codes listed in figure 1. You may enter any number of bytes at a time, and the screen display should tally with figure 2. If you make a mistake input "S", which will stop the program. To recommence, simply Goto 10, and enter your new starting address.

When this is complete — and you should have Saved your program at several stages — Save the program thus far.

If your ZX-81 has the "unimproved" Rom, identified by Print Peek 5404 giving 253, then you must enter the five Pokes in fig.2 before Saving and proceeding further.

Type in program 3. This is most of the Basic required to transfer the code to upper memory and provide the operating menu. When you have Saved this, Run it. You should now have the menu on screen, so select 8 — Renumber — and enter the numbers 290, 460, 1, and 10222 in response to the prompts.

Almost immediately, the menu lines will be renumbered from A222 to A239 — 10222 to 10239.

If all is well, type in program 4, the remaining Basic, and Save the program again. You are now ready to Save this, the final completed program in auto-run mode. To do this simply Run the program whilst recording in the usual way. When the program has Saved, you will find that the Basic program area has been cleared and the menu lines are now stored above Ramtop where they will remain until required. Similarly, this occurs when you Load the auto-run version.

The Invisible Toolkit is now ready to use, so refer to the instructions and try it out.

Using the toolkit is easy. After Loading,

RAND USR (ZX81 + 2)

retrieves the Basic from above Ramtop, and Goto 10222 displays the menu. The first

(continued on next page)

Program 1.

```
   1 REM ..........................
..................................
.........
  20 POKE 16511,68
  30 POKE 16512,3
  40 FOR N=16514 TO 17347
  50 POKE N,1
  60 NEXT N
```

Program 2.

```
 10 INPUT S
 20 LET A$=""
 30 GOSUB 0160
 40 IF A$="" THEN INPUT A$
 50 IF A$="S" THEN STOP
 60 LET X=16*CODE A$+CODE A$(2)
-476
 70 POKE S,X
 80 LET Y=Y+X
 90 LET C=C+1
100 LET S=S+1
110 PRINT A$( TO 2);" ";
120 LET A$=A$(3 TO )
130 IF C=5 THEN GOSUB 0150
140 GOTO 0040
150 PRINT TAB 25;Y
160 LET Y=0
170 LET C=0
180 PRINT S;TAB 8;
190 RETURN
```

Program 3.

```
  10 LET F=16568
  20 LET L=764
  30 POKE 16444,F-256*INT (F/256
)
  40 POKE 16445,INT (F/256)
  50 POKE 16446,L-256*INT (L/256
)
  60 POKE 16447,INT (L/256)
  70 RAND USR 16767
  80 RAND USR 16522
  90 LET ZX81=PEEK 16388+256*PEE
K 16389+153
 100 FAST
 110 FOR N=0 TO 21
 120 PRINT "                    
          "
 130 NEXT N
 140 PRINT AT 1,1;"[illegible]
DING A PAGE NOTE -"
 150 PRINT AT 3,6;"ZX81=";ZX81;A
T 5,6;"PEEK 16507=";PEEK 16507;A
T 7,6;"PEEK 16508=";PEEK 16508
 160 PRINT AT 10,1,"[illegible]
[illegible]"
 170 PRINT AT 12,6;" RAND USR (Z
X81+2)"
 180 PRINT AT 15,1,"[illegible]
[illegible]";AT 17,6;"GOTO 10222"
 290 FAST
 300 PRINT AT 0,10;"[illegible]
[illegible]";AT 2,0;"1.DN CODE-:LINE:AD
DR:";AT 4,0;"2.DNBASIC-:";AT 6,0
;"3.LN ADDR-:LINE:";AT 8,0;"4.RE
M EXP-:LINE :BYTE:ADDR:";AT 10,0
;"5.UP CODE-:ADDR:BYTE:";AT 12,0
;"6.UPBASIC-:1ST :LAST:";AT 14,0
;"7.BLK DEL-:1ST :LAST:";AT 16,0
;"8.RENUM.B-:1ST :LAST:INCR:NEWL
:";AT 18,0;"9.RENUM.C-:       :
INCR:NEWL:";AT 21,0;"ENTER NO."
 310 INPUT N
 320 PRINT AT 2*N,1;"■"
 330 FOR M=1 TO 4
 340 INPUT Z
 350 PRINT AT 2*N,6*M+6;"     ";
AT 2*N,6*M+4;Z
 360 POKE 16442+M*2,Z-256*INT (Z
/256)
 370 POKE 16443+M*2,INT (Z/256)
 380 NEXT M
 390 CLS
 400 IF N=2 OR N=9 THEN RAND USR
 (ZX81+590)
 410 IF N=1 OR N=2 OR N=9 THEN R
AND USR (ZX81+555)
 420 LET ZX82=USR (ZX81+2*N-2)
 430 IF N=5 OR N=6 OR N=9 THEN R
AND USR (ZX81+581)
 440 IF N=3 THEN PRINT "ADDRESS
OF LINE ";PEEK 16444+256*PEEK 16
445;" IS ";ZX82
 450 REM
 460 REM
```

Program 4.

```
   2 SAVE "TOOLKIT"
 190 FAST
 200 POKE 16444,10222-256*INT (1
0222/256)
 210 POKE 16445,INT (10222/256)
 220 POKE 16446,10239-256*INT (1
0239/256)
 230 POKE 16447,INT (10239/256)
 240 RAND USR (ZX81+10)
 250 POKE 16444,1
 260 POKE 16445,0
 270 LET N=7
 280 GOTO 10235
```

(continued from previous page)

prompt requires you to input your selection — 1 to 9 — and the next four prompts expect numerical input, for example line number, Address — or any number if the menu indicates a blank.

When you wish to Load another program on which to use the toolkit, there are a couple of things to remember. First make sure that the menu lines are back above Ramtop — if not, use Copy Basic to do so. Then note down the contents of locations 16507 and 16508, as you will need to restore them after Loading.

Also, the variable ZX-81 will have to be restored after Loading — also after Run and Clear, which are best avoided.

After you have LOADed the program you intend to work on, and restored the system variables 16507 and 16508, and ZX-81

RAND USR (ZX81 + 2)

and away you go!

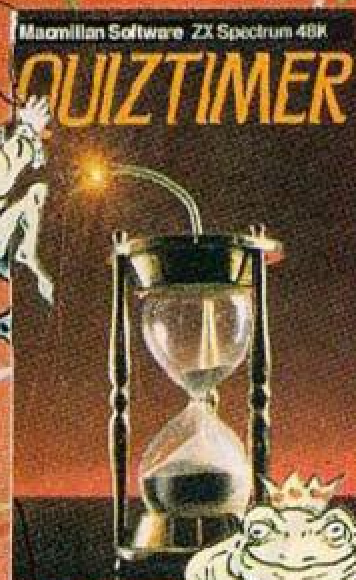
Figure 1.

```
16514  00 00 D1 00 53  =292
16519   00 76 75 ED 5B  564
16524  04 40 ED 53 7B  =511
16529  40 21 81 40 CD  =495
16534  A5 40 D5 3E 02  =506
16539  CD A5 40 CD AD  =812
16544  40 3D 20 F7 C9  =605
16549  23 4E 23 46 EB  =453
16554  09 EB C9 EB FD  =933
16559  E1 C1 C5 71 23  =763
16564  70 EB FD E9 2A  =075
16569  3C 40 CD D8 09  =554
16574  E5 2A 3F 40 23  =432
16579  CD D8 09 D1 CD  =844
16584  17 0F C9 2A 04  =280
16589  40 E5 2A 3E 40  =461
16594  18 13 18 F5 21  =345
16599  10 27 22 2B 40  =196
16604  2A 04 40 E5 CD  =544
16609  B6 05 EB CD D8  =848
16614  09 E5 2A 7B 40  =467
16619  ED 5B 04 40 CD  =601
16624  17 0A E1 E5 C5  =684
16629  2B CD 9E 09 C1  =608
16634  D1 E1 C5 ED B0  =1044
16639  C1 C6 2A 02 40  =490
16644  09 22 02 40 ED  =346
16649  73 36 40 2A 36  =329
16654  40 09 F9 A7 ED  =726
16659  42 ED 5B 04 40  =462
16664  EB A7 ED 52 44  =789
16669  4D ED 5B 7B 40  =592
16674  2A 04 40 ED 53  =430
16679  04 40 19 2B ED  =375
16684  E6 18 34 2A 3C  =362
16689  40 CD D8 09 44  =562
16694  4D C9 ED 4B 3E  =652
16699  40 2A 40 40 2B  =277
16704  E5 C5 CD 9E 09  =798
16709  C1 E1 C5 41 3E  =742
16714  1B 23 77 10 FC  =449
16719  18 13 18 81 18  =219
16724  81 18 D8 18 DF  =616
16729  18 24 18 2B 18  =151
16734  77 18 77 18 77  =485
16739  2A 3C 40 CD D8  =587
16744  09 C1 20 0B 23  =280
16749  23 5E 23 56 EB  =485
16754  09 EB 72 2B 73  =516
16759  2A 29 40 09 22  =190
16764  29 40 C9 2A 3C  =406
16769  40 ED 4B 3E 40  =502
16774  1B 03 CD B8 40  =480
16779  C5 D5 E5 CD C5  =1041
16784  0E 2A 04 40 22  =158
16789  76 40 A7 ED 42  =657
16794  22 04 40 C5 E5  =528
16799  2A 02 40 A7 ED  =512
16804  42 22 02 40 ED  =403
16809  73 36 40 2A 36  =329
16814  40 A7 ED 42 F9  =783
16819  09 ED 5B 7B 40  =524
16824  EB A7 ED 52 44  =789
16829  4D 2A 36 40 ED  =474
16834  73 5D 40 ED 5B  =600
16839  5D 40 ED B0 E1  =795
16844  C1 D1 D5 EB ED  =1087
16849  B0 E1 D1 C1 C9  =1004
16854  18 04 18 1E 18  =106
16859  12 CD B8 40 C5  =605
16864  CD 60 0A 2A 29  =394
16869  40 A7 C1 ED 42  =727
16874  22 29 40 C9 FD  =593
16879  CB 01 EE FD CB  =89A
16884  01 A6 18 52 FD  =526
16889  CB 01 AE FD CB  =834
16894  01 A6 21 7D 40  =389
16899  FD CB 01 9E E5  =844
16904  23 23 23 23 7E  =266
16909  FE FA 20 04 FD  =793
16914  CB 01 DE 7E FE  =806
16919  76 C1 23 28 1F  =417
16924  2B C5 7E CD 84  =751
16929  07 7E FE EC 28  =663
16934  2B FE ED 28 21  =601
16939  FE F7 28 1D FD  =823
16944  CB 01 3C 20 20  =365
16949  DF E1 CD F2 09  =904
16954  EB ED 5B 0C 40  =639
16959  A7 E5 ED 52 E1  =940
16964  28 04 18 B8 18  =279
16969  B6 18 3C 23 23  =336
16974  23 23 23 E5 7E  =460
16979  CD B4 07 20 2D  =469
16984  23 7E FE 76 20  =565
16989  27 E1 E5 FD CB  =949
16994  01 65 20 29 23  =211
16999  7E 23 5E 23 56  =375
17004  23 4E 23 46 CD  =423
17009  8D 15 C5 E1 CD  =789
17014  D8 09 18 02 18  =275
17019  BA E5 C1 E1 2B  =576
17024  70 2B 71 18 81  =469
17029  D1 18 AE FD CB  =563
17034  01 66 28 56 C9  =432
17039  2B 56 2B 5E EB  =501
17044  CD B8 05 42 4B  =538
17049  C5 CD 20 15 CD  =660
17054  F6 13 C1 E1 E5  =914
17059  C5 23 77 23 73  =501
17064  23 72 23 71 23  =332
17069  70 C1 E1 2B 18  =597
17074  02 18 93 16 04  =199
17079  E5 D5 CD 20 15  =700
17084  EF C0 34 01 0A  =494
17089  00 CD 20 15 EF  =497
17094  C1 05 24 C2 E1  =653
17099  04 E2 01 03 E2  =455
17104  34 CD A7 0E C5  =635
17109  CD CD 15 C1 D1  =833
17114  E1 C6 1C 77 2B  =513
17119  15 20 D5 18 96  =440
17124  18 CD 2A 7B 40  =453
17129  22 46 40 2A 04  =214
17134  40 FD CB 01 6E  =531
17139  20 18 00 00 00  =56
17144  00 00 00 2A 3E  =104
17149  40 23 CD D8 09  =529
17154  22 46 40 2A 3C  =270
17159  40 CD D8 09 00  =494
17164  00 ED 4B 40 40  =440
17169  ED 5B 42 40 C5  =655
17174  D5 D1 C1 7A FE  =001
17179  28 38 03 11 0F  =131
17184  27 72 23 73 2B  =346
17189  EB 09 EB C5 D5  =889
17194  CD F2 09 EB ED  =926
17199  5B 46 40 A7 E5  =621
17204  ED 52 E1 20 DE  =798
17209  D1 D1 FD CB 01  =875
17214  E6 FD CB 01 6E  =797
17219  C0 18 9E 21 FE  =661
17224  27 CD D8 09 23  =504
17229  23 5E 23 56 13  =269
17234  13 72 2B 73 19  =316
17239  2B 01 02 00 C5  =243
17244  E5 CD 9E 09 D1  =810
17249  C1 21 7B 40 ED  =650
17254  B0 C9 CD 23 0F  =632
17259  21 FE 27 CD D8  =747
17264  09 23 23 5E 23  =208
17269  56 D5 1B 1B 72  =467
17274  2B 73 D1 D5 19  =605
17279  7E FE EA 20 07  =653
17284  D1 2B 72 2B 73  =524
17289  CF 13 D1 01 02  =438
17294  00 C5 11 7C 40  =402
17299  ED B8 23 C1 E5  =878
17304  09 EB E1 CD 60  =770
17309  0A C9 2A 04 40  =321
17314  7E FE 20 30 09  =477
17319  2A 7B 40 2B 7E  =398
17324  FE 76 28 02 CF  =621
17329  1C C9
```

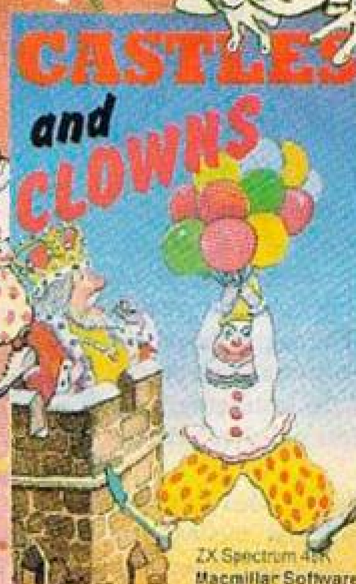
Figure 2.

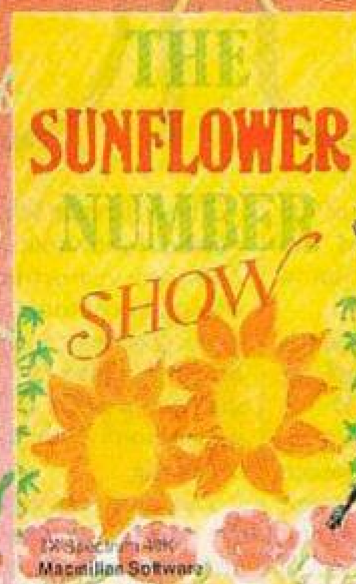
```
POKE 17051,28
POKE 17054,244
POKE 17082,28
POKE 17091,28
POKE 17110,201
```

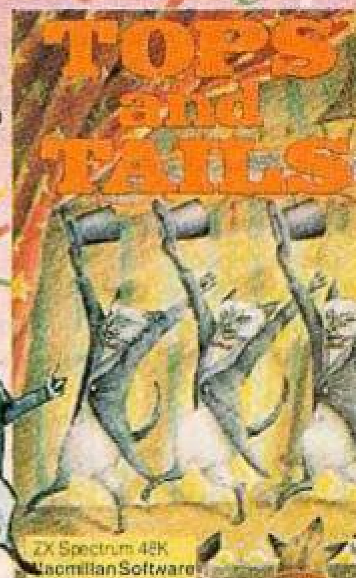
Something to celebrate!

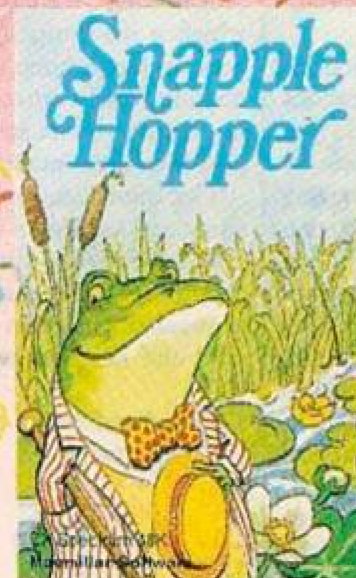












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Phil Holliday with more on the QL's assembly language.

TUTORIAL

THIS MONTH I complete the description of the 68008 instruction set which I started last month. I also provide a brief introduction to QDOS.

Three instructions are included which operate on byte sized operands and perform Bindary Coded Decimal — BCD — arithmetic. The add decimal with extend instruction ABCD — adds the source operand and destination operand and extend bit together using BCD arithmetic, placing the result in the destination operand and if necessary setting the extend bit to allow multi-precision BCD arithmetic.

The operands must either both be contained in data registers, or else in memory locations addressed indirectly through address registers. In the case of memory to memory addition only the predecrement addressing mode is available, to facilitate multi-precision addition.

The subtract decimal with extend instruction — SBCD — subtracts the source operand and extend bit from the destination operand using BCD arithmetic. The addressing modes are the same as for the ABCD instruction.

The negate decimal with extend instruction — NBCD — subtracts the desination operand, which is of size byte, and the extend bit, from zero placing the result in the destination. Thus the instruction produces the ten's complement of a BCD number if the extend bit is reset and the nine's complement otherwise.

Program control instructions cover jump, branch, set and returns, both conditional and unconditional. First, a word about the 68008 notation which I find confusing. To me a jump is the assembler equivalent of a Goto instruction whereas a call is the equivalent of a Gosub instruction. In the 68008 instruction set both branch and jump — BRA and JMP — are used as Goto and branch to sub routine and jump to subroutine — BSR and JSR — are used as Gosub.

The difference between branch and jump — whether to sub routine or not — is as follows: A branch instruction can cause program execution to continue at a displacement relative to the program counter. The displacement can be either signed byte — to give a short branch shown as a suffix .S after the instruction — or signed word. This produces position independent code.

The jump instruction on the other hand can use many different addressing modes and thus allows a jump to an address greater than plus or minus 32K from the program counter which is the limitation of the branch instruction. In fact a jump can use any effective addressing mode other than the obvious ones, i.e, register direct modes, pre-decrement and post-increment modes and immediate modes.

The conditional instructions provide branching and setting on the following conditions. The table below shows the mnemonic, the condition and the state of the flags for the test to succeed. Note that true test will always succeed and the false test will always fail. The

Code	Condition	Test
T	true	1
F	false	0
HI	high	not C , not Z
LS	low or same	C + Z
CC	carry clear	not C
CS	carry set	C
NE	not equal	not Z
EQ	equal	Z
VC	overflow clear	not V
VS	overflow set	V
PL	plus	not N
MI	minus	N
GE	greater or equal	N . V + not N . not V
LT	less than	N. not V + not N . V
GT	greater than	N . V . not Z + not N . not V . not Z
e	ss or equal	Z + N . not V + not N . V

equal test will only succeed if the zero (Z) bit is asserted.

So now on to the actual instructions first, the branch instructions. The branch always — BRA, branch conditional — Bcc — and branch to subroutine — BSR — all produce a program counter relative branch. The conditional instruction is formed by taking the required conditional mnemonic and replacing the cc to give BEQ,BNE etc.

There is also a test condition, decrement and branch instruction (DBcc) which I described last month.

The jump instructions follow a similar pattern and are jump — JMP — and jump to subroutine — JSR. You will see that there is no conditional jump and so if you need to jump rather than branch conditionally you will need to perform a conditional branch to a jump instruction.

The set according to condition instruction — Scc — sets a byte operand to true — all ones — if the condition is true, else it sets the byte to false — all zeros.

There are two Return instructions to enable return from a subroutine. Return from subroutine — RTS — pulls the program counter from the top of the stack. Return and restore pulls both the condition codes and program counter from the stack. Note however, that branch and jump to subroutine instructions do not store the condition codes on the stack so if you wish to use this instruction your subroutine must store the condition codes on the stack at the start of the subroutine.

System control instructions fall into three categories, i.e. privileged, trap generating and status register instructions.

As was briefly mentioned in last month's article the 68008 can operate in two different modes, namely user and superviser mode. Superviser mode is the indicated by bit 13 of the status register being set, and provides some additional instructions — i.e. privileged

instructions — which are not available when operating in user mode. They are as follows:

Three instructions are provided to provide immediate bitwise logical manipulation of the status register. They are ORI to SR, ANI to SR and EORI to SR and all have size word.

A special move instruction, move to status register, is available with operand size word which allows the whole of the status register to be loaded. So far all these instructions are privileged because they potentially can set the superviser bit in the status register, and this is not a facility available to programs operating in user mode.

There is also an instruction to move the user stack pointer to an effective address. This enables the user stack to be examined when in superviser mode.

And finally in the privileged set of instructions there are Stop which halts the program execution, Reset which resets external devices and return from exception — RTE — which is a return from interrupts, traps and pulls both the status register and program counter from the stack.

There are three trap generating instructions, trap — Trap — trap on overflow — TrapV — and check register against bounds — CHK. A trap forces execution to continue at an address held in a table of vectors near the bottom of program memory and also causes the processor to enter supervisor mode. There are 16 Trap vectors, and the first five, i.e., Trap # 0 forces the processor into superviser mode. Trap # 1,2 and 3 are system call traps with the particular call recognised by a number passed in d0.

Trap # 4 is used by the Basic command interpreter. The other traps can be redirected using a QDOS system call. TrapV is used to force a trap on overflow so that the programmer has control of the situations when this would or would not be catastrophic. CHK allows the contents of a data register to be checked against some boundary conditions, forcing a trap exception if the data register is out of bounds.

Finally, the status register instructions which are not privileged. The condition code register — CCR — is the low byte of the status register. So ANDI to CCR, ORI to CCR, EORI to CCR Move to CCR are all byte size versions or the similar instructions already described in the privileged instruction section above. There is also a move status register to effective address which allows the status register to be stored.

A brief introduction to QDOS is an essential part of a series on assembler on the 68008, but brief is the operative word. To do justice to the subject would require a book, and in Part 1 of this series I gave the names of two such books. So instead of attempting to cover the various system calls, etc, I will try to give



you the flavour of QDOS without going into detail.

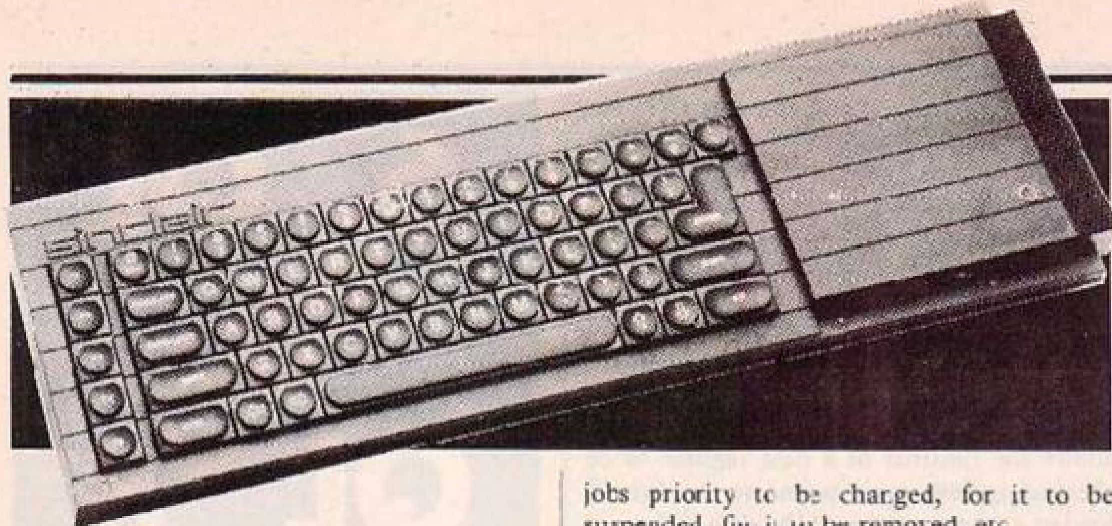
What is QDOS? It is a collection of software procedures — system calls — which can be invoked by assembly language programs — using a Trap instruction — to perform commonly required operations on the QL.

These operations include manager traps which manage the QL's resources, to allocation traps which allocate input and output channels and serial io traps which execute serial i/o operations and include all the screen driver routines.

An executable program — i.e. one which is activated using the Exec command on the QL

(continued on next page)

```
LOC     OBJECT       STMT  SOURCE STATEMENT
                     2
                     3 *Copyright P.A.Holliday 1985
                     4 *demonstration of multi-tasking
                     5 *assembled with METACOMCO assembler
                     6
        =FFFF        7 this_job  equ -1
                     8
        =0108        9 mt_susjb  equ $108
        =0111        10 mt_ipcom  equ $111
                     11
                     12 QDOS      macro
                     13           moveq #\1&$FF,d0
                     14           trap #\1/$100
                     15           endm
                     16
                     17 *first initialise loop counter
                     18
0000'   740C         19 start     moveq #12,d2
                     20
                     21 *then go brrr-brrr
                     22
0002'   6116         23 loop      bsr.s ring
0004'   6114         24           bsr.s ring
                     25
                     26 *now wait a bit
                     27
0006'   611E         28           bsr.s delay
                     29
                     30 *and loop back if d2 not yet = -1
                     31
0008'   51CA FFF8    32           dbra d2,loop
                     33
                     34 *now wait for 60 secs by suspending job
                     35 *for 3000 frames
                     36
000C'   72FF         37           moveq #this_job,d1
000E'   363C 0BB8    38           move.w #3000,d3
0012'   93C9         39           suba.l a1,a1
                     40           QDOS mt_susjb
0014'   7008         40+          moveq #mt_susjb&$FF,d0
0016'   4E41         40+          trap #mt_susjb/$100
                     41
                     42 *then do it all again
                     43
0018'   60E6         44           bra.s start
                     45
                     46 *sub routine to go brrr
                     47
001A'   47FA 0018    48 ring      lea ptr_blk,a3
                     49           QDOS mt_ipcom
001E'   7011         49+          moveq #mt_ipcom&$FF,d0
0020'   4E41         49+          trap #mt_ipcom/$100
0022'   6102         50           bsr.s delay
0024'   4E75         51           rts
                     52
                     53 *sub routine to suspend job for
                     54 *0.8 second,i.e.40 frames
                     55
0026'   72FF         56 delay     moveq #this_job,d1
0028'   363C 0028    57           move.w #40,d3
002C'   93C9         58           suba.l a1,a1
                     59           QDOS mt_susjb
002E'   7008         59+          moveq #mt_susjb&$FF,d0
0030'   4E41         59+          trap #mt_susjb/$100
0032'   4E75         60           rts
                     61
                     62 *parameter block for beep
                     63 *these were found by trial and error
                     64
0034'   0A           65 ptr_blk   dc.b $A    beep cmd
0035'   0A           66           dc.b 10    no of ptrs
0036'   FFF0 0AAA    67           dc.l $FFF00AAA size string
003A'   0A           68           dc.b 10    pitch 1
003B'   0D           69           dc.b 13    pitch 2
003C'   8002         70           dc.w 32770   grad_x
003E'   1B20         71           dc.w 6944 duration
0040'   08           72           dc.b 8     grad_y
0041'   01           73           dc.b 1     wrap
0042'   00           74           dc.b 0     rand
0043'   00           75           dc.b 0     fuzz
0044'   01           76           dc.b 1     no reply
                     77
                     78           end
```



(continued from previous page)

— or on which is in the resident procedure area and is executed with a Call command is known as a job. A job can be in one of three distinct states, known as active, suspended or inactive.

QDOS supports a multi-tasking environment. That is more than one job can appear to be running at the same time. This is not in fact what actually happens. The 68008 processor can only execute one instruction at a time, and so each job is given a priority and is allocated an appropriate slice of the processors time by the scheduler, which is activated 50 times a second by the hardware interrupt.

An active job will have a priority of from 1 to 127 — the higher the number the greater the amount of time allocated to it by the scheduler. A suspended job will have been created with a priority just like an active job, but the scheduler will not allow it to run for a given number of time slices. An inactive job has a priority of 0. The manager traps enable a jobs priority to be changed, for it to be suspended, for it to be removed, etc.

Other manager traps control allocation of memory in the transient procedure are and the resident procedure area, enable communication with the second processor which handles the serial io ports, sound generation and the keyboard. Finally, there are a set of traps which allow QDOS to be extended with additional user written device drivers and interrupt servers, making it possible for instance to extend QDOS to handle disk drives or to perform terminal emulation.

The io allocation traps enable jobs to open and close channels, to format media and to delete files.

The serial io traps enable data to be read or written to an opened channel either a byte at a time or as a string of bytes. The screen driver commands cover operations to modify a window, control the cursor, clear a part of a window, set the colours and perform some graphic operations on a window such as plot, draw etc. There are also some traps to enable the file subsystem to deal with direct access files and entire file load and save.

There are also some utility routines which are not strictly a part of QDOS in that they are not essential to the operation of the QL, and the most important of these utilities is the Basic interpreter.

This months program example will produce a sound like a telephone, whilst any other program, either Basic or executable machine code, is running. The program is commented and is self explanatory. To run it type Exec filename — I have called mine phone exc — and it will ring 12 times, followed by one minutes's delay, after which it will repeat ad nauseam.

Next month I will present a major routine written in assembler. It is a debug program which will allow registers and flags to be displayed and changed, programs to be loaded and then single stepped, and several other features. ■

FALL GUY

Competition RESULTS

Two TICKETS to Hollywood were on offer as the first prize in January's Fall Guy competition. For the runners-up there were three BMX bikes. To be in the running you had to identify eight computers from their photographs.

Then we asked you to dream up a title for a new blockbuster TV series or film about computers. The computers in the photographs were as follows: 1. Enterprise; 2. Spectrum +; 3. Newbrain; 4. Atari 600 XL; 5. Acorn Atom; 6. Acorn Electron; 7. Text TX-8000; 8. Commodore Plus 4.

The hope of being Westward Bound inspired a number of highly entertaining entries. Film buffs will spot the references among the following suggestions: "I Married a Blob from Sinclair Research" from A. Miller; "Indiana Jones and the Architecture of the 6800" from P. Manolis; "Hackers of the Late ROM" from A. Johnson; and C. Lane's "The Kilobyte Syndrome".

One of the best was V. Carroll's "Core Binary! It's Cursorman". This was just pipped at the post for the one of the first prizes by "Qwerty Harry with Squint Eastward" from R. H. Storey 18, Conifer Close, Lutterworth, Leics. We awarded the other trip to Hollywood to J. Mirson, 6 Muswell Avenue, London N10, who supplied not just one title but a complete TV schedule for a new computer, Channel 5:

5.30 THE CLIVE AND CHRIS SHOW
Zany slapstick comedy from a Cambridge pub.

6.00 NEWS
Read by a Currah Speech Unit.

6.30 KNIGHT RIDER
Thrills and spills as Sir Clive takes to the road in his trustry C5 ... after dark! Who is the mystery computer magnate in the Rolls Royce behind? Last in the series.

7.15 Q.L. DONGLE
The cop with the detachable bit. Postponed from June 1984.

8.00 SPACE TREK
The good ship Enterprise finally arrives somewhere — even later than Q.L. Dongle!

9.00 NEWS
With sub-titles for those who couldn't understand the Currah.

9.30 THE BIG FILM: THE RISE AND FALL OF THE ROM ADD-ON EMPIRE
(Disaster movie; 1984) The dramatic fortunes of Dave Ian, Bruce and Eugene, four kids living fast in a world that defines Imagination! Not suitable for children.

11.00 INTERNATIONAL BOXING
Jack Tramiel vs The Kommodore Killer. Plus after the (last orders) bell action from The Baron of Beef, Cambridge. Blood 'n' bytes action. Not suitable for anyone.

12.00 HAWAII 5:0
Steve McCarrot investigates a ZX81 Error Code in the Pacific. (B/W)

12.30 CLAIRE RAMERS POCKET COMPUTER
Claire Ramer is forced to betray the confidences of more clients in order to afford new Eproms for her Psion Organiser.

1.00 SHUTDOWN
Caused by an overheating power supply.

Working on the basis that anyone over 18 was too old to win one of the three BMX bikes, we awarded them instead to T. Blacke, 8 Valley Gardens, Downend, Bristol; S. Nolan, 48 Hhanemann Rd, Liverpool; H. Halton, 39 Primrose Lane, Burton Ave., Hunslet, Leeds.

TOP★ TIPS

CHARACTER SET

This short machine-code listing for the 48K Spectrum instantly redefines the complete Spectrum character set, giving any program that professional look (see below). It occupies a meagre 30 bytes but the character data it creates takes up over 760.

Type in the listing and then save it before running.

```
9000 CLEAR 64568
9010 FOR F=65220 TO 65365: READ
a: POKE F,a: NEXT F
9020 RANDOMIZE USR 65330
9030 DATA 33,0,61,17,37,252,1,0,
3,120,203,47,182,18,19,35,11,121
,176,32,244,33,57,251,34,54,92,2
01
```

PRINTER/PLOTTER

Owners of Commodore's 1520 printer/plotter know that it has the device number 6 instead of the usual number 4. This means the plotter cannot be used as a printer with software that uses a printer with device number 4. This short routine (below) allows the plotter to be addressed with a 4. It is activated by Sys 679.

```
1 REM BASIC LOADER TO ENABLE
2 REM 1520 PRINTER/PLOTTER TO USE
3 REM A DEVICE NUMBER OF 4
4 REM BY MARK HIRD
5 REM ACTIVATE BY 'SYS 679
6 REM MUST BE RE-ACTIVATED AFTER
7 REM A WARM START
10 FORL=0TO22
20 READA:POKEL+679,A
30 NEXT
40 DATA 169,120,141,[illegible],3,169,2,141,27,3,
96,[illegible],72,165
50 DATA 186,201,4,208,4,169,6,133,186,10
4,40,76,74,243
```

FILL ROUTINE

Below is a machine-code fill routine. It is possible to break it with Symbol Shift and Stop. The routine also sometimes breaks itself to prevent a crash. When you Run the program, it asks you where to place the routine. Remember to put it above Ramtop.

Example: Putting the routine at 32000.
Type CLEAR 31999: RUN
Type 32000
SAVE example: (still 32000)
SAVE "fill"CODE 32000,95
LOAD example:
LOAD "fill"CODE 32000
Use the routine *this* way:
PLOT INVERSE l,x,y LET
L = USR routine address.

```
  5 LET t=0
 10 INPUT "add": FOR n=0 TO 95
 20 READ a: POKE n+add,a
 25 LET t=t+a
 30 NEXT n
 35 IF t<>10413 THEN PRINT "Dat
a Error"
 40 DATA 237,91,125,92,213,205,
191,2,209,254,225,204,62,5,42,10
[illegible]
66,75,205,178,34,71,4,72,125,7,1
6,203,203,71,192,203,194,65,16,1
6,203,119,75
 50 DATA 38,0,51,175,1,6,203,64
0,42,230,240,111,41,41,203,57,20
[illegible]
,22,205,4,125,20,20,205,4,136,65
,20,205,4,125,21,21,205,4,125,10
,201,0
```

RESPONSE *Frame*

Do you have a problem related to your micro? Tim Hartnell will do his best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you'd like to pass on to others. Why not write to us with your top tips?

RETAIL PROBLEM

Please inform any software retailers reading this magazine that not *all* of their customers are budding pirates. On purchasing a tape for my ZX Spectrum, I found that it would not load. After several attempts using a variety of tape recorders to try and load it in, I decided to return it. The next morning I took it back complete with receipt of purchase. However, they insisted on trying it on their tape recorder and computer. To my surprise, it loaded. I was then asked to bring my computer into the centre. So, in the afternoon I took in my computer for them to try with their tape recorder. As I expected, it did not load. Then I was told that because the tape loaded on their machine there was nothing wrong with it and I could not get my money back. Please tell me, have I the right to my money back?

Greg Wills,
Yeovil.

OF COURSE you have. Under the Sale of Goods Act, the product sold has to be suitable for the purpose for which it was sold. Your tape plainly is not suitable.

You are far too patient. I would have refused to bring my computer into the store; created a scene; insisted that the manager be called, and demanded — in a very loud voice — that I get my money back.

Failing this, I would — as I have done in the past, I am not always a popular customer — called in the local Fair Trading officer: you can find out who this is from your council or citizen's advice centre. This threat invariably brings results. At the very least, they should have offered to exchange your tape for another one of the same game, and if this did not load, given you your money back without quibbling at all. Take this reply to the store, and demand your money back.

COPY DUMP

I have an Alphacom 32 printer attached to my Spectrum. I have discovered that while I can dump hi-res pictures from the screen of nearly all commercial programs I own — such as *Valhalla* — I cannot do it with *The Hobbit*. Does this mean that the Alphacom is not totally compatible with the Spectrum? I only get rubbish when I try to Copy frames from *The Hobbit*. Why is this?

J M Holiday,
Shoeburyness,
Essex.

I RANG PHILIP Mitchell, the programmer who wrote *The Hobbit* and put your question to him. He said the fault does not lie in your printer. The program was written in such a way that it is not possible to access the Copy command while a hi-res picture is on the screen. However, you should have no trouble dumping text.

TUNEFUL BBC

Recently I watched a commercial piece of software loading on a BBC Micro, and was amazed to hear a tune being played at the same time. I think this is a very good idea, as it is often so boring waiting for the program to load. Could you tell me how I could do this?

N A Holland,
Geudros,
Swansea.

TO DO THIS, you have to be able to divert the CPU's interrupt calls to your own program, while the other loading continues. This means you have to go into machine code. Therefore, it is not a particularly easy thing to do.

WHICH MICRO?

I am 16 years old and am thinking of buying my first computer. I am mainly thinking of the Commodore 64. The computer I buy will be used for playing games and doing some simple programming. I have read in many magazines, including *Your Computer*, comments that the 64 is difficult to program, and that an upgraded Basic should be bought for this purpose. Could you please tell me if the 64's Basic is adequate for my use, or should I buy a better Basic. If so, which one should I buy?

Vincent Juddenham,
Malbarton,
Norwich.

IT IS UNREALISTIC to talk about buying an upgraded Basic for a computer you have not yet used. Many, many people — possibly the largest group of computer owners in the world — have found the 64's Basic more than adequate. It is not, however, an easy Basic to use, with extremely unfriendly graphics and sound commands. Despite this, extremely good results can be obtained.

If you are still in the beginner stages of using a computer, which I assume you are from your letter, you might be better served with the Spectrum, or Spectrum+, if you can accept the non-standard keyboard.

Finally, if you can afford it, I suggest you should seriously investigate the BBC Micro or Amstrad, as these give you access to computing power of a standard which the Spectrum and Commodore 64 do not possess.

SAVE MY WORK

I have recently been working on a long, complex graphics program for the 48K Spectrum, but have hit upon disaster. I recorded over part of my only copy, and so I am now unable to use it. Every time I reach this spot in loading, I get a tape loading error. The last line loaded, 6316, is filled with question marks. Deleting this line does nothing. Is there any way I can save my work?

D Naylor,
Huby,
Leeds.

IT SEEMS that the simplest way to do it would be to LList the corrupted version, and type it in again. And, never only take one copy of important programs.

M/C SCROLL

I am writing to you to inquire whether it would be possible for you to write me a small machine language routine which would scroll ASCII characters right and left, as in *Frogger*? This would be for my Atari 600XL.

S Hawkes,
West Bromwich,
West Midlands.

ROUTINES FOR scrolling vertically and horizontally appear from page 200 onwards of the book *Mastering the Atari* by Derryl Severn — ISBN 0 907563 88 0 — which costs £5.95.

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PM C16 CASSETTE DATA UNIT

Designed for use with Commodore +4, Commodore 64 and Vic 20. This cassette unit is a device for storing and recalling computer programs on ordinary cassette tapes. It can be used for saving programs you have written and want to recall for later use. It can also be used to read pre-recorded programs that you have purchased. **£24.95**



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	ADDRESS.................................
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Sawmill

Nick Hockaday,
Shepherds Bush,
London W12.



A COMPANY WITH tree plantations connected by trails in timber country has given you a contract to supply their four sawmills with logs. You have hired three tree felling crews and you have a truck with which to transport crews or to collect and deliver logs. For safety reasons you cannot transport logs and crews together.

A crew that has been dropped at a plantation will work diligently while you use the truck for other business but the crew will not move to another plantation unless you take them there. You may call a crew to you by sounding a siren on your truck.

Your truck can carry a maximum of nine logs but if you attempt to overfill it, you will find that another log will fall off and be lost. The maximum speed of the truck is governed by the terrain and the log-load. Each sawmill shows in green the number of logs that it has in hand for processing, but if the number is less than 20 the display is white. These numbers will decrease periodically as the logs are processed but will increase if you make a delivery. Your score will show the total number of logs that you have delivered. If any sawmill runs out of logs then your contract is terminated and the game is over.

SOFTWARE *File*

Programs for Software File should be fairly compact and sent on a cassette. Please include clear instructions and say what computer it's for. We pay between £6 and £36 for programs published. They must be double-checked and submitted to *Your Computer* exclusively.

Operating instructions.
To move truck North press A.
To move truck South press Z.
To move truck West press O.
To move truck East press P.
To call crew press C.
To Quit press Q.
To Hold press H.
To Resume after hold re-press H.

To drop off a crew, stop the truck on the trail alongside the required position and press the appropriate direction key. Because of the bumpy ride you must not carry a crew if you are driving on a plantation. To pick up a log, press appropriate direction key. If you inadvertently drive into a tree, it will be up-rooted but will not be suitable as a log for a sawmill.

To deliver logs, stop the truck on the trail alongside any sawmill and press A. If the truck is on a trail you may call a nearby crew to you by pressing C.

To enter the program, first type and save program 1. Then enter and run the hex loader. Now enter program 2 and save it using:

SAVE "a" CODE 40672,404

Next enter and save the program 3 with:

SAVE "b" CODE 40672,1420

Delete the hex loader and enter and save program 4.

Program 1.

```
   2 REM "t"
   4 CLEAR 39999
   6 PRINT AT 7,0; PAPER 5; BRIG
HT 1;"TIMBER!.....© NICK HOCKADA
Y 1985"
   8 LOAD "a"CODE 40672,404
  10 RANDOMIZE USR 41000
  12 LOAD "b"CODE 40672,1420
  14 LOAD "c"
```

The hex loader.

```
  10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
  20 INPUT "Start ";s
  30 INPUT "Finish ";f
  40 FOR n=s TO f STEP 8
  50 LET tot=0: PRINT n;"  ";
  60 INPUT h$: PRINT h$;
  70 LET x=0
  80 FOR b=1 TO LEN h$ STEP 2
  90 LET z=FN h(h$): LET tot=tot
+z
 100 POKE n+x,z
 110 LET h$=h$(3 TO ): LET x=x+1
 120 NEXT b
 130 PRINT " = ";: INPUT t: PRIN
T t
 140 IF tot<>t THEN PRINT "input
 error - try again": GO TO 50
 150 NEXT n
 160 REM enter STOP to stop
```

Program 2.

```
40672: BBF4BFBFBFBF4AEA = 1503
40680: EAEAEAE4BFBFBFBF = 1694
40688: 9DF49B9B9B9F48A8 = 1265
40696: ABABABE49B9B9B9F = 1356
40704: B9F49DDDDDDD48CC = 1525
40712: CCCCCCC49DDDDDDF = 1630
40720: 9DF4444444444444 = 809
40728: 444444444444449F = 635
40736: B9F4AEAAAAAE4AAA = 1361
40744: AAAAAAAAAE4BF49F = 1332
40752: 9DD48ABECECE48CC = 1337
40760: CCECCECECE49F49D = 1532
40768: 44448CECBC8E4444 = 930
40776: ABAE8C8C8E49F444 = 1149
40784: AAE4A8E7778E4BF4 = 1377
40792: BECE777ABE49F4AE = 1222
40800: BCE48CC0008C49F4 - 1157
40808: BC8C111BCC49D48E = 952
40816: ABE44446664449F4 = 1021
40824: 444466664444448E = 684
40832: BCE4AAAAAAAE49F4 = 1369
40840: BBF4AEAEAEAE4ABE = 1343
40848: ABE48ECCCCCC49D4 = 1435
40856: 9DF48ABABABE48EC = 1265
40864: BCC48E4444444444 = 818
40872: 49F48ECCCCCE48AE = 1319
40880: 44448E4AAAAAAAAE = 1036
40888: 49F48AE7778E48EC = 1255
40896: BBF48E48ECCCCECE = 1497
40904: 49D48CC3338C48AE = 1057
40912: 9DF48E48E7778E8E = 1249
40920: 44444446664448CC = 720
40928: B9F48C48C2228C8C = 1149
40936: 4AAE4BBBBBBF4444 = 1024
40944: 9DF4444446664444 = 845
40952: 48EC49DDDDDD4EBF = 1310
40960: B9BBBF4AAAAAE4AA = 1375
40968: A8AE4444444449FD = 940
40976: 9FDFDF48ECECE48E = 1519
40984: CECE4BBBBBBBB9BF = 1424
40992: 9D9D9D48C8C8C48C = 1279
41000: 8C8C49DDDDDDDDDD = 1458
41008: 11409C21DF9E23D5 = 899
41016: E51130A0AFED52E1 = 1173
41024: D1D00602AFED6FCB = 1151
41032: 5F2806E607F6A018 = 808
41040: 1DCB572813E60328 = 651
41048: 07FE022807AF180E = 523
41056: 3E40180A3E601806 = 348
41064: E6033C07C6201213 = 567
41072: 10D218C200 = 444
```

Program 3.

```
40672: 00385C7C38101000 = 360
40680: 0000113377FF99FF = 850
40688: 00000000007E7E00 = 252
40696: 00003C3C3C3C0000 = 240
40704: D5E5C5F5110F0021 = 949
40712: 800ACDB503F1C1E1 = 1186
40720: D1C9D5E5C5F5110F = 1326
40728: 00210002CDB503F1 = 665
40736: C1E1D1C9C5E5D544 = 1535
40744: 4D114044A7ED5277 = 831
40752: 606911409DED5260 = 854
40760: 6911405C390F1140 = 430
40768: 9EED526069114055 - 044
40776: 380311404EA7ED52 = 704
40784: D106081A77132410 = 439
40792: FAE1C1C9E515106B - 1255
40800: 260029292929295A = 333
40808: 16001911409C19EB = 544
40816: E1C9C57D9330027B = 1068
40824: 954F7C9230027A94 = 818
40832: 813DC1C9E5D51140 = 1107
40840: 44373FED52CBB6D1 = 1099
40848: E1C9E5D511404437 = 1072
40856: 3FED52CBF6D1E1C9 = 1466
40864: D5C5F5ED5B94A4CD = 1500
40872: 5C9FED5396A41A32 = 961
40880: 9CA4ED5B98A4CD5C = 1261
40888: 9FED539AA41A329D = 1030
40896: A4ED5B7CA4AF2A7E = 1123
40904: A4ED522002CBC7A7 = 1086
40912: 2AB0A4ED522002CB = 890
40920: CFA72A82A4ED5220 = 1061
40928: 02CBD7329FA4F1C1 = 1227
40936: D1FE012A94A4C8FE = 1272
40944: 022A96A4C8FE032A = 857
40952: 98A4C8FE042A9AA4 = 1134
40960: C8FE052A9CA4C32A = 1063
40968: 9EA4C9CBF4CBACCB = 1548
40976: E454CBA54D3E04CD = 1028
40984: A09F7211F89E73CD = 1181
40992: 249F3E02CDA09F71 = 896
41000: 11003D3E28CB7928 = 544
41008: 023E30CD249F3E03 = 577
41016: CDA09F227CA4C93A = 1105
41024: 7AA4FE0121500028 = 694
41032: 18FE02213E002B11 = 432
41040: FE0321300028AFE = 642
41048: 04212600280321 1E = 181
41056: 0022BEA4AFCB1CCB = 949
41064: 1D2270A421200022 = 478
41072: 92A46F672275A432 = 889
41080: 7BA42284A42286A4 = 949
41088: 2288A4228AA43C32 - 780
41096: 74A43279A43C3C32 = 785
41104: 9EA4210A09227CA4 = 696
41112: 227EA42280A42282 = 814
```

(continued on next page)

(continued from previous page)

```
41120:  A4213200110A0022 = 308
41128:  6CA419226EA41922 = 564
41136:  70A4192272A42140 = 710
41144:  9C2277A411E09EAF = 1047
41152:  E5ED52E1302E7ECB = 1196
41160:  7F2810E607F6A077 = 945
41168:  11E09E3E30CD249F = 909
41176:  2318E1CB77280AE6 = 886
41184:  E07711003D3E2818 = 547
41192:  ECCB6F28EB11E89F = 1232
41200:  3E6818E121689D3E = 771
41208:  707711F89E3E68CD = 1025
41216:  249FC9ED5E7CA4CD = 1217
41224:  5C9FEB0601CB7E28 = 862
41232:  0206053A7EA48047 = 557
41240:  2105001101001710 = 97
41248:  FD228CA406032100 = 633
41256:  0011000223E5ED52 = 602
41264:  E138F910F12183A4 = 1115
41272:  0604235E23561372 = 393
41280:  2B732310F5AF2A84 = 803
41288:  A4ED5B8CA4ED52D2 = 1325
41296:  73A2AF2A86A4ED5B = 1120
41304:  8EA4ED52D235A2AF = 1225
41312:  2A88A4ED5B90A4ED = 1215
41320:  52D2F5A1AF2A8AA4 = 1218
41328:  ED5B92A4ED5238AC = 1185
41336:  676F228AA41179A4 = 852
41344:  1A474FFE032001AF = 641
41352:  3C12217CA4232310 = 485
41360:  FC5E2356D5CD5C9F = 1136
41368:  1AD16B62CB7FCA03 = 975
41376:  A1E606280AFE0228 = 743
41384:  08FE0428061C1C1D = 397
41392:  151414152294A4ED = 665
41400:  5398A4D5CD5C9F1A = 1094
41408:  D1E618C203A1217C = 976
41416:  A441232310FC7323 = 717
41424:  723E02CDA09FCB9E = 1063
41432:  CBF6CB6E11003D28 = 880
41440:  0311F09E3E30CD24 = 769
41448:  9F3E04CDA09FCBDE = 1174
41456:  CD929FC303A1676F = 1083
41464:  2288A42A77A45747 = 817
41472:  3A785C5F1911E09E = 789
41480:  A7E5ED52E1380511 = 1018
41488:  A002ED522277A4E6 = 1028
41496:  0328010478F6C047 = 677
41504:  7EE6F990200CCBEE = 1234
41512:  CB8611E09E3E30CD = 1099
41520:  249FC303A1676F22 = 802
41528:  86A43A74A4474F21 = 819
41536:  6AA4232310FC5E23 = 737
41544:  561B722B737AB320 = 718
41552:  10064021C05A3610 = 471
41560:  2310FB3E0332815C = 638
41568:  C9413E078032815C = 734
41576:  79FE042001AF3C32 = 697
41584:  74A4C9676F2284A4 = 1025
41592:  ED5B7CA43A005C47 = 837
41600:  3A045CB8380178FE = 769
41608:  4FCA2BA3FE5ACA27 = 1072
41616:  A3FE41CA29A3FE50 = 1222
41624:  CA25A3FE43281AFE = 1043
41632:  512309FE48C203A1 = 814
41640:  3E0218023E01060A = 169
41648:  CD129F10FB32815C = 970
41656:  C93A9EA4FE03287D = 1003
41664:  3A78A4A72077D5CD = 1081
41672:  5C9FEBCB7ED1206D = 1165
41680:  2A7EA4CD729F470E = 895
41688:  012A80A4CD729FB8 = 997
41696:  3002470C2A82A4CD = 674
41704:  729FB830020E0306 = 530
41712:  0ACD009FCD129F10 = 772
41720:  F8D5217CA4412323 = 917
41728:  10FC5E2356E5CD5C = 1009
41736:  9FEBCB9ECDB49FE1 = 1476
41744:  D1722B73CD5C9FEB = 1172
41752:  CD929F219EA4343E = 979
41760:  0C32815CC9141D1C = 561
41768:  1C1D1415AFBA280D = 512
41776:  BB280A3E21BA2805 = 563
41784:  3E16B82006CD009F = 673
41792:  C303A12A7CA42294 = 871
41800:  A4ED5398A43E05CD = 1072
41808:  A09F7CE688FE3828 = 1239
41816:  177CA72813E6E0FE = 1081
41824:  20203E7DE6E0FE60 = 1055
41832:  20063A7BA4A72006 = 588
41840:  CD009FC303A14F7C = 926
41848:  0FE607473C3C3C32 = 553
41856:  815C216AA4232310 = 610
41864:  FC78327BA45E2356 = 924
41872:  FB09EB722B732A75 = 910
41880:  A4092275A4CD129F = 870
41888:  C93A9EA4A72846CB = 1061
41896:  7C28423E06CDA09F = 822
41904:  444D3D3DCDA09FCB = 994
41912:  DECD929F3D3DCDA0 = 1219
41920:  9F0D2003CDB49F3C = 763
41928:  CDA09FCB50280522 = 886
41936:  82A4180CCB482805 = 650
41944:  2280A418032278A4 = 677
41952:  219EA4353E0C3281 = 661
41960:  5CCD129FC97CE6E0 = 1253
41968:  FEA0200B0630CD0B = 727
41976:  A0CD129FC303A1FE = 1155
41984:  E0201F0630CD0DA0 = 719
41992:  3A7BA43CFE0A2006 = 707
42000:  CD009FC303A1327B = 896
42008:  A43E0C32815CCD12 = 732
42016:  9FC9CB7C280B0630 = 792
42024:  CD0FA0CD129FC303 = 960
42032:  A13A9EA4A7200B06 = 757
42040:  28CD0FA0CD129FC3 = 997
42048:  03A1E53E06CDA09F = 985
42056:  7CE1F5066ECD0FA0 = 1084
42064:  F1CB5728032282A4 = 902
42072:  CB4F2803228 0A4CB = 854
42080:  472803227EA4CD12 = 661
42088:  9FC303A100 = 518
```

Program 4.

```
   2 REM "c"
  10 IF a>999 THEN LET a=999
  12 LET i$=STR$ a
  14 IF LEN i$<3 THEN LET i$=" "+i$: GO TO 14
  16 LET p=4: IF a<20 THEN LET p=7
  18 RETURN
  20 LET a=PEEK 42092+256*PEEK 42093
  22 GO SUB 10
  24 PRINT AT 7,7; PAPER p; BRIGHT 1;i$
  26 RETURN
  30 LET a=PEEK 42094+256*PEEK 42095
  32 GO SUB 10
  34 PRINT AT 7,20; PAPER p; BRIGHT 1;i$
  36 RETURN
  40 LET a=PEEK 42096+256*PEEK 42097
  42 GO SUB 10
  44 PRINT AT 15,9; PAPER p; BRIGHT 1;i$
  46 RETURN
  50 LET a=PEEK 42098+256*PEEK 42099
  52 GO SUB 10
  54 PRINT AT 13,23; PAPER p; BRIGHT 1;i$
  56 RETURN
  70 LET w=PEEK 42107: LET c=PEEK 42142: LET l=PEEK 42106
  72 LET i$="LOAD    EMPTY *LEVEL "
  74 IF w=0 THEN GO TO 80
  76 LET i$(6)=STR$ w: IF w=1 THEN LET i$(8 TO 12)="LOG  ": GO TO 86
  78 LET i$(8 TO 12)="LOGS ": GO TO 86
  80 IF c=0 THEN GO TO 86
  82 LET i$(6)=STR$ c: IF c=1 THEN LET i$(8 TO 12)="CREW ": GO TO 86
  84 LET i$(8 TO 12)="CREWS"
  86 PRINT AT 21,0; PAPER 4; BRIGHT 1;i$;l
  88 RETURN
 100 GO SUB 70
 102 LET s=PEEK 42101+256*PEEK 42102: PRINT AT 21,21; PAPER 4; BRIGHT 1;"*SCORE     ": PRINT AT 21,32-LEN STR$ s; PAPER 4; BRIGHT 1;s
 104 IF j=4 THEN GO SUB 20: GO TO 114
 106 IF j=5 THEN GO SUB 30: GO TO 114
 108 IF j=6 THEN GO SUB 40: GO TO 114
 110 IF j=7 THEN GO SUB 50: GO TO 114
 112 GO SUB 20: GO SUB 30: GO SUB 40: GO SUB 50
 114 RANDOMIZE USR 41219
 200 LET j=PEEK 23681
 202 IF j=8 THEN GO SUB 20: GO TO 114
 204 IF j=9 THEN GO SUB 30: GO TO 114
 206 IF j=10 THEN GO SUB 40: GO TO 114
 208 IF j=11 THEN GO SUB 50: GO TO 114
 210 IF j=12 THEN GO SUB 70: GO TO 114
 212 IF j=1 THEN GO TO 610
 214 IF j=2 THEN GO TO 300
 216 IF j=3 THEN GO TO 350
 218 GO TO 100
 300 PRINT AT 21,0; PAPER 4; BRIGHT 1;"NOW REPRESS h"
 302 IF INKEY$<>"" THEN GO TO 302
 304 IF INKEY$="" THEN GO TO 304
 306 LET i$=INKEY$: IF i$<>"h" THEN GO TO 302
 308 PRINT AT 21,0; PAPER 4; BRIGHT 1;" ";TAB 12;" "
 310 IF INKEY$<>"" THEN GO TO 310
 312 GO SUB 70: GO TO 114
 350 BORDER 2: LET c=PEEK 42100
 352 LET a=7: LET b=7: IF c=2 THEN LET b=20
 354 IF c=3 THEN LET a=15: LET b=9
 356 IF c=4 THEN LET a=13: LET b=23
 358 PRINT AT a,b; PAPER 2; INK 7; BRIGHT 1; FLASH 1;"*": PRINT PAPER 7; BRIGHT 1;" 0"
 360 PRINT AT 21,0; PAPER 4; BRIGHT 1;"* GAME  OVER"
 362 FOR n=20 TO -10 STEP -1: BEEP .02,n: NEXT n
 364 PRINT AT 3,3; PAPER 4; BRIGHT 1;"* FOR NEW GAME....PRESS y *"
 366 IF INKEY$<>"" THEN GO TO 366
 368 IF INKEY$="" THEN GO TO 368
 370 LET i$=INKEY$: IF i$<>"y" THEN GO TO 366
 372 GO TO 610
 600 PAPER 6: INK 0: CLS : PRINT AT 7,12; PAPER 5;"TIMBER!"
 602 PRINT AT 9,6; PAPER 5;"© NICK HOCKADAY 1985"
 604 PRINT AT 19,8;"NOW PRESS ENTER"
 606 IF INKEY$<>"" THEN GO TO 606
 608 IF INKEY$="" THEN GO TO 608
 800 CLS : PRINT AT 3,0;"There are 5 levels ranging from level 1, the easiest, to level 5, the most difficult."
 802 PRINT AT 7,0;"WHICH LEVEL DO YOU WISH TO PLAY ON?"
 804 PRINT AT 11,6;"PRESS 1,2,3,4 or 5"
 806 IF INKEY$<>"" THEN GO TO 806
 808 IF INKEY$="" THEN GO TO 808
 810 LET i$=INKEY$: IF CODE i$<49 OR CODE i$>53 THEN GO TO 808
 812 LET c=VAL i$: POKE 42105,c
 814 CLS : LET j=0: PRINT AT 3,2;"YOU HAVE SELECTED LEVEL ";c
 816 PRINT AT  ,0;"Before you press ENTER to play, remember that at the start you have three crews on your truck."
 818 PRINT AT 11,0;"Crew positions are always shown bright."
 820 PRINT AT 17,3;"NOW PRESS ENTER TO PLAY"
 822 IF INKEY$<>"" THEN GO TO 822
 824 IF INKEY$="" THEN GO TO 824
 826 CLS : RANDOMIZE USR 41023: GO TO 100
```

Mutant's Revenge

Martin Hargreaves,
Allerton,
Bradford.

ZX-81

MUTANT'S REVENGE IS for the 16K ZX-81. The principle of the game centres around the arcade classic Defender except you are one of the mutants.

The object is to guide your mutant onto a humanoid, capture it and take it skywards. Sounds easy? As you will find out, it is very

hard and will take some mastering.

The program itself has everything the average computer games freak wants. Fast, original, good graphics, Hall of Fame, 100 skill levels etc.

Line 1 should contain at least 94 full stops. On line 1530 it mentions 12* graphic "G s". This means that you must type in the graphic "G" character 12 times.

When it has all been keyed in you must save before running. To save type Goto 1890. This saves the program with the name "Mut" and runs automatically on loading. There is a variable in this program called At, this should not be confused with the keyword At.

When you run this program your ZX-81 will move into Fast mode to load some machine code. You do not need to type in hex or decimal codes blindly as the program has it all in memory at line 20 and a built-in interpreter. As soon as the machine code is loaded it is executed twice using Rand USR 16514.

You will then be asked at what speed you wish to play — 0 to 9. Note the absence of an input sign to avoid data entry errors. Then you are asked for the fuel consumption rate, again, in a range of 0 to 9 and no input sign.

When both the skill levels have been entered a neat little routine will display what keys are needed to control your mutant. This gives you time to fumble about and get your fingers over the right keys, which are:

C = up.
A = down.
O = left — thrust.
P = right — thrust.
I = hyperspace.

Your first job is to capture a humanoid "o". These are randomly scattered across the landscape. Your mutant is situated at the far left-hand side of the screen steadily moving right. The O and P keys serve as thrust and reverse keys. This means that if you press O your mutant will keep moving left unless told otherwise. These features make the mutant more manoeuvrable as he can now move in diagonals. If he hits the far left/right hands of the screen don't worry as he will re-appear on the other side.

When you hit a humanoid you will be awarded 10 points this will be shown on the "score" gauge and the humanoid gauge will decrease by one.

Once you have captured a humanoid phase two begins. This involves taking the humanoid skywards. Your mutant moves up automatically so it is just a job of avoiding pyrenoids and the gate. The gate is a hole situated in the grey bar at the top of the screen which moves from side to side. Pyrenoids are asterisks which float in the sky — contact with one will prove fatal.

If you manage to carry your humanoid through the gate you are awarded a mystery amount of points and you will return to the left of the screen to try and capture another.

If all the humanoids have been captured you are said to have completed an attack wave and a bonus of 30 points will be added to your score. When all humanoids have been captured you will go on to the attack wave sequence. Sometimes, however, your mutant will return to the left of the screen even though there are no corresponding humanoids. In this case just move through the gate and move to the top of the screen.

If you score 500, 600 or 800 then you will be awarded an extra man and the game speed will hot up. The screen will clear and another random landscape will be drawn and play will continue.

This program is fitted with a special key which, when pressed, shoots you out of trouble and throws your mutant into a random position on the screen.

```
   1 REM .....94 FULL STOPS ....
  10 FAST
  20 LET A$="3E0ECD93403E80CD934
0010000CDF5060C32F0C400E150620502
077CDD54015020F50E5D0601210000770C
DD54010020F8C10D5C2577CDD5401520F
85F78FE08C87B055EC5012100ED42770
DD54010020F7C10D18C5F53EC03D20FDF
1C9"
  30 LET MC=16514
  40 FOR I=1 TO LEN A$ STEP 2
  50 POKE MC,16*(CODE A$(I)-28)+
CODE A$(I+1)-28
  60 LET MC=MC+1
  70 NEXT I
  80 SLOW
  90 POKE 16535,23
 100 POKE 16575,9
 110 POKE 16599,190
 120 DIM L(10)
 130 DIM K$(2)
 140 DIM N$(11,20)
 150 FOR F=1 TO 10
 160 LET N$(F)="(C)  H.P.H SOFTW
ARE."
 170 NEXT F
 180 LET N$(11)="1 LIFE LOST"
 190 RAND USR 16514
 200 POKE 16418,2
 210 RAND USR 16514
 220 REM END OF MACHINE CODE.
 230 REM MUTANTS REVENGE (C) BY
M.P.HARGREAVES [illegible]
 240 PRINT AT 5,5;"INPUT SPEED (
[illegible] 9)";AT 7,9;"0=EASY 9=HARD"
 250 LET K$(1)=INKEY$
 260 IF K$(1)>"9" OR K$(1)<"0" T
HEN GOTO 250
 270 LET SP=CODE K$(1)-28
 280 LET SP=SP+6
 290 LET SP=SP/10
 300 PRINT AT 10,0;"INPUT FUEL C
ONSUMPTION (0 TO 9)";AT 12,8;"0=
EASY 9=HARD"
 310 LET K$(2)=INKEY$
 320 IF K$(2)>"9" OR K$(2)<"0" T
HEN GOTO 310
 330 LET FC=CODE K$(2)-28
 340 LET FC=FC+1
 350 LET FC=FC/10
 360 GOSUB 1320
 370 LET A$="[illegible]
[illegible]"
 380 LET S=0
 390 LET AT=1
 400 LET LI=5
 410 LET B$="[illegible]"
 420 FOR F=5 TO 2
 430 PRINT AT F,0;F$;AT F+19,0;A
$
 440 NEXT F
 450 PRINT AT 0,13;CHR$ 154;AT 6
,7;"""Q"" = UP";AT 8,7;"""A"" =
DOWN";AT 10,7;"""O"" = LEFT";AT
12,7;"""P"" = RIGHT";AT 14,7;"""
I"" = HYPERSPACE";AT 1,2;"M U T
A N T S  R E V E N G E";AT 20,8;
"[illegible]"
 460 IF INKEY$="" THEN GOTO 460
 470 RAND USR 16514
 480 POKE 16418,0
 490 FAST
 500 LET D=14
 510 LET HU=0
 520 LET H=15
 530 LET FU=31
 540 FOR F=0 TO 31
 550 IF F>2 AND F<28 THEN PRINT
AT INT (RND*H-3),F CHR$ 151
 560 PRINT AT 2,F;CHR$ 138;AT 23
F;CHR$ 133
 570 LET I=INT (RND*30)
 580 LET H=H+(I>15 AND H<20)-(I<
=15 AND H>6)
 590 IF I>15 THEN PRINT AT H F;C
HR$ 6
 600 IF I<=15 THEN PRINT AT H+1,
F;CHR$ 134
 610 IF F>28 AND HU=0 OR I>28 OR
 I<3 AND F>1 AND F<31 AND HU<>0 T
HEN GOSUB 640
 620 NEXT F
 630 GOTO 670
 640 PRINT AT 21,HU+1;CHR$ 180;T
AB HU-1;CHR$ 5;AT H-1,F CHR$ 180
 TAB F;CHR$ 8
 650 LET HU=HU+1
 660 RETURN
 670 FOR F=11 TO 9+LI STEP 2
 680 PRINT AT 22,F;CHR$ 182
 690 NEXT F
 700 SLOW
 710 PRINT AT 22,20;"SCORE=";S
 720 LET A=3+INT (RND*8)
 730 LET CA=0
 740 LET B=0
 750 FOR B=B TO 31 STEP SP
 760 GOSUB 870
 770 IF INKEY$="O" THEN GOTO 810
 780 NEXT B
 790 LET B=0
 800 GOTO 750
 810 FOR B=B TO 0 STEP -SP
 820 GOSUB 870
 830 IF INKEY$="P" THEN GOTO 750
 840 NEXT B
 850 LET B=31
 860 GOTO 810
 870 PRINT AT A,B;
 880 LET P=PEEK (PEEK 16398+PEEK
 16399*256)
 890 IF FU<=0 OR P>5 AND P<152 A
ND P<>128 THEN GOTO 1280
 900 IF P=180 THEN GOTO 970
 910 IF HU=0 AND A=0 THEN GOTO 1
140
 920 PRINT CHR$ 192;AT A,B;B$;AT
 23,FU;CHR$ 103
 930 LET FU=FU-FC
 940 LET A=A+(INKEY$="A" AND A<1
9)-(INKEY$="Q" AND CA=0)
 950 IF INKEY$="I" THEN GOSUB 13
90
 960 RETURN
 970 LET HU=HU-1
 980 GOSUB 1120
 990 LET CA=1
1000 LET S=S+10
1010 PRINT AT A,B;"[illegible]";AT 21,HU+
1;B$;TAB HU+1;B$;AT 22,26;S;AT A
,B;B$;AT A,B+1;B$
1020 LET A=A-1
1030 FOR A=A TO 0 STEP -SP
1040 GOSUB 870
1050 LET B=B+(INKEY$="P" AND B<3
1)-(INKEY$="O" AND B>0)
1060 PRINT AT 2,D;"[illegible]";AT A,
B;CHR$ 180;AT A,B;B$
1070 LET D=D+(D<0)-(D>0)
1080 IF D=0 THEN GOSUB 1120
1090 NEXT A
1100 LET S=S+5+INT (RND*15)
1110 ROTO 710
1120 LET Q=INT (RND*27)
1130 RETURN
1140 RAND USR 16514
1150 PRINT AT 10,3;"ATTACK WAVE
";AT;"COMPLETED";AT 12,10;"BON
US = 30"
1160 FOR F=1 TO 40
1170 NEXT F
1180 LET S=S+30
1190 IF S>800 OR S>500 AND S<600
 THEN GOSUB 1220
1200 LET AT=AT+1
1010 COTO 470
1220 FOR F=0 TO 40
1230 PRINT AT 14,10;"BONUS LIFE"
;AT 14,10;"BONUS LIFE"
1240 NEXT F
1250 LET LI=LI+2
1260 LET FC=FC+0.05
1270 RETURN
1280 LET LI=LI-2
1290 FOR F=1 TO 11
1300 PRINT AT F+1,0;N$(11,F)
1310 NEXT F
1320 PRINT AT 22,LI+11;B$
1330 FOR F=2 TO 12
1340 PRINT AT F,0;B$;AT 2,0;CHR$
 138
1350 NEXT F
1360 IF LI=0 THEN GOTO 1430
1370 IF CA=1 THEN GOTO 930
1380 GOTO 630
1390 PRINT AT A,B;B$
1400 LET A=3+INT (RND*4)
1410 LET B=INT (RND*31)
1420 RETURN
1430 PRINT AT 10,11;"GAME OVER"
1440 FOR F=0 TO 40
1450 NEXT F
1460 RAND USR 16514
1470 POKE 16418,2
1480 FOR J=1 TO 10
1490 IF S>=L(J) AND S>0 THEN GOS
UB 1780
1500 IF S>=L(J) AND S>0 THEN GOT
O 1710
1510 NEXT J
1520 CLS
1530 PRINT AT 2,9;"HALL OF FAME"
;TAB 9;"12*GRAPHIC G",,,"PLACE";
TAB 10;"NAME";TAB 27;"SCORE";AT
18,10;"""1"" TO PLAY";TAB 3;"""2
"" TO RESET HIGH SCORES";TAB 3;"
""3"" TO CHANGE DIFFICULTY"
1540 FOR J=1 TO 10
1550 PRINT AT J+6,2;J;TAB 6;N$(J
);AT J+6,28;L(J)
1560 NEXT J
1570 FOR F=0 TO 63
1580 PLOT F,8
1590 PLOT F,31
1600 PLOT F,34
1610 NEXT F
1620 FOR F=8 TO 34
1630 PLOT 11,F
1640 PLOT 52,F
1650 NEXT F
1660 PRINT AT 0,0;"ON ATTACK WAV
E ";AT;" YOUR SCORE=";S
1670 IF INKEY$="1" THEN GOTO 360
1680 IF INKEY$="2" THEN GOTO 120
1690 IF INKEY$="3" THEN GOTO 210
```

(continued on next page)

SOFTWARE *file*

Grid Challenge

John Consadine,
Swanland,
North Humberside.



IN GRID CHALLENGE you are shown a grid of 390 slots each referenced by a letter and number. Each slot is filled with one of up to 39 different characters randomly chosen and then hidden from your view.

The object of the game is to pick two matching characters. If you are successful you are allowed another go. This continues until you make an error when it is the computer's turn. It is allowed only one turn as it gets the answer right every time.

To give you a fighting chance, if you type Peek you will be allowed a quick look at the grid at any time but a check is kept on how often you do this. Also typing Score will show your total successes so far.

The duration of the game may be shortened if required by reducing the values of TP and TC in lines 10000-10010. The harder the game you choose the more different characters are used. Your concentration will be pushed to the limit!

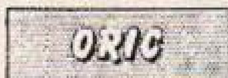
```
10 REM*****************
20 REM GRID CHALLENGE
30 REM
40 REM J.CONSADINE
50 REM   15/8/84
60 REM*****************
100 DIMX(27,16),A$(27,16),FL(27,16)
110 XD$="■":FORX=1TO25:CD$=CD$+XD$:NEXT
120 XR$="■":FORX=1TO39:CR$=CR$+XR$:NEXT
130 EE$=" ":FORX=1TO80:E$=E$+EE$:NEXT:E$="■"+E$+"■"
132 AA$="1234567x91234557x912345612345 67x9<[]7x9"
134 BB$="12345678912345578****■1123456789<[]■"
136 CC$="12346578 9()<?#■)+****■1123456789<[]■"
140 DD$="*%#$%+()<?#■)+****■1123456789<[]■"
145 AL$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
150 SP$="■ "
180 PE=0:TP=0:TC=0:INPUT"■DIFFICULTY(1-EASIEST,4-HARDEST)";TU
185 IFTU<1ORTU>4THEN180
200 PRINT"■THROW DICE FOR WHO GOES FIRST."
230 GOSUB8500:P=INT((6*RD)+1):GOSUB9000
240 PRINT"■YOU THROW A ";:PRINTP:GOSUB9000
245 GOSUB8500:C=INT((6*RD)+1):IFC=PTHEN245
250 PRINT"■I THROW A ";:PRINTC:GOSUB9000
260 IFP>CTHENPRINT"■YOU GO FIRST---":FL=1:GOSUB9000:GOTO280
270 PRINT"■I GO FIRST---":FL=2:GOSUB9000
280 PRINT"■PLEASE WAIT"
497 REM*******************
498 REM SET UP CHR ARRAY
499 REM*******************
500 GOSUB545:L=1
510 FORA=1TO26:FORB=1TO15
512 A$(A,B)=MID$(C$,L,1):L=L+1
514 IFL=40THENL=1:GOSUB545
516 NEXT:NEXT
520 GOSUB8000
525 IFFL=1THEN3000
530 GOTO2000
545 C$="":B$=""
550 FORX=1TO39
552 IFTU=1THENB$=MID$(AA$,X,1)
554 IFTU=2THENB$=MID$(BB$,X,1)
556 IFTU=3THENB$=MID$(CC$,X,1)
558 IFTU=4THENB$=MID$(DD$,X,1)
560 RD=RND(RND(0)):RN=INT((RD*2)+1)
580 IFRN=1THEN600
590 C$=B$+C$:GOTO605
600 C$=C$+B$
605 NEXT:RETURN
997 REM*****************
998 REM CURSOR CONTROL
999 REM*****************
1000 NR$="":ND$=""
1010 NR$=LEFT$(CR$,X):ND$=LEFT$(CD$,Y)
1020 NR$="■"+NR$:ND$="■"+ND$:RETURN
1500 GOTO8000
1997 REM*************
1998 REM COMPUTERS GO
1999 REM*************
2000 PRINTE$,"NOW IT'S MY TURN":GOSUB9000
2010 GOSUB8500:RN=INT(RD*20)
2020 IFRN=5AND(TC>TP)THENPRINTE$,"I SEE I'M STILL WINNING!"
2030 IFRN=10AND(TC>TP)THENPRINTE$,"YOU'LL HAVE TO DO BETTER THAN THIS !"
2040 IFRN=5AND(TC=TP)THENPRINTE$,"WE'RE LEVEL NOW BUT NOT FOR LONG!"
2050 IFRN=5AND(TC<TP)THENPRINTE$,"YOU'RE AHEAD NOW BUT I'LL STOP THAT "
2055 IFRN=5ORRN=10THENGOSUB9000
2060 PRINTE$,"MY FIRST CHARACTER IS---":GOSUB9000
2097 REM********************
2098 REM FIND 1ST FREE CHR
2099 REM********************
2100 FORX=1TO26:FORY=1TO15
2115 IFA$(X,Y)<>SP$THEN2130
2120 U=X:V=Y:X=26:Y=15
2130 NEXT:NEXT
2132 X=U:Y=V:GOSUB9600:GOSUB9000
2134 PRINTE$:"MY MATCHING CHARACTER IS---"
2197 REM**********************
2198 REM FIND NEXT MATCHING CHR
2199 REM**********************
2200 FORX=U+1TO26:FORY=1TO15
2220 IFA$(X,Y)=A$(U,V)THENS=X:T=Y:X=26:Y=15
2230 NEXT:NEXT
2236 X=S:Y=T:GOSUB9600:GOSUB9000
2238 GOSUB9000:TC=TC+1:A$(S,T)=SP$:A$(U,V)=SP$
2240 X=S:Y=T:GOSUB9600:X=U:Y=V:GOSUB9600
2244 GOSUB10000:REM CHECK WIN/LOSE
2997 REM***********
2998 REM PLAYERS GO
2999 REM***********
3000 PRINTE$:INPUT"■PICK A SQUARE (G7,L13,ETC)■";B$:RN=0
3030 IFB$="*"THEN3000
3031 IFB$="PEEK"THENGOSUB8500:RN=INT(RD*20):PE=PE+1:GOTO3033
3032 GOTO3037
3033 IFRN=1THENPRINTE$,"CHEAT!!"
3034 IFRN=5THENPRINTE$;"TUT TUT!!"
3035 IFRN=10THENPRINTE$;"YOU MUST HAVE A BAD MEMORY!"
3036 GOSUB8100:GOTO3000
3037 IFB$="SCORE"THENPRINTE$;"SCORES  YOU-■"TP"■ ME-■"TC:GOSUB9000:GOTO3000
3040 U$=MID$(B$,1,1):FL=0:FORM=1TO26:IFU$=MID$(AL$,M,1)THENFL=1:N=M:M=26
3050 NEXT:IFFL=0THEN3000
3060 V=VAL(MID$(B$,2)):IFV<1ORV>15THEN3000
3065 U=N:X=U:Y=V:XX=X:YY=Y:IFA$(X,Y)=SP$THEN3000
3070 GOSUB9600
3080 PRINTE$:INPUT"■PICK ANOTHER TO MATCH■";B$
3100 IFB$="*"THEN3000
3110 J$=MID$(B$,1,1):FL=0:FORM=1TO26:IFJ$=MID$(AL$,M,1)THENFL=1:N=M:M=26
3120 NEXT:IFFL=0THEN3000
3130 V=VAL(MID$(B$,2)):IFV<1ORV>15THEN3000
3140 J=N:X=J:Y=V:IFA$(X,Y)=SP$THEN3000
3145 IFX=XXANDY=YYTHEN3000
3150 GOSUB9600
3160 IFA$(XX,YY)=A$(X,Y)THENPRINTE$,"■THEY MATCH!!":GOSUB9000:TP=TP+1
3165 IFA$(XX,YY)=A$(X,Y)THENGOSUB10000:A$(X,Y)=SP$:GOSUB9600:MA=1
3166 IFMA=1THENMA=0:A$(XX,YY)=SP$:X=XX:Y=YY:GOSUB9600:GOTO3000
3170 PRINTE$;"NO MATCH!":GOSUB9000:GOSUB1000:PRINTNR$;ND$;"."
3172 X=XX:Y=YY:GOSUB1000:PRINTNR$;ND$;".":GOTO2000
7997 REM**********
7998 REM DRAW GRID
7999 REM**********
8000 PRINT"■";AL$
8010 PRINT"■1"+CR$+"2"+CR$+"3"+CR$+"4"+CR$+"5"+CR$+"6"+CR$+"7"
8020 PRINT"■8"+CR$+"9"+CR$+"■10"+CR$+"■11"+CR$+"■12"
8030 PRINT"■13"+CR$+"■14"+CR$+"■15"
8090 PRINT"■"
8095 PRINTE$,"I'LL LET YOU HAVE A QUICK PEEK AT THE   GRID  ";
8097 PRINT"TYPE ■PEEK■ TO VIEW ANY TIME."
8100 FORX=1TO26:FORY=1TO15
8110 GOSUB1000:PRINTNR$;ND$;A$(X,Y):NEXT:NEXT
8112 FORX=1TO26:FORY=1TO15
8113 IFA$(X,Y)=SP$THENGOSUB9600:GOTO8120
8114 GOSUB1000:PRINTNR$;ND$;"."
8120 NEXT:NEXT:RETURN
8500 RD=RND(RND(0)):RETURN
9000 FORD=1TO1500:NEXT:RETURN
9500 GETA$:IFA$=""THEN9500
9510 RETURN
9600 GOSUB1000:PRINTNR$;ND$;A$(X,Y):RETURN
10000 IFTC>97THENPRINTE$:"YOU CANNOT BEAT ME NOW,I'M TOO FAR AHEAD!":GOSUB9000
10005 IFTC>97THEN10030
10010 IFTP>97THENPRINTE$:"YOU HAVE BEATEN ME THIS TIME!":GOSUB9000:GOTO10040
10020 RETURN
10030 PRINT"■YOU LOST THIS TIME!!":GOTO10050
10040 PRINT"■CURSES YOU WON THIS TIME !"
10050 PRINT"■THE SCORES WERE---"
10060 PRINT"■YOU ■"TP"■POINTS (BUT YOU PEEKED";PE;"TIMES)"
10070 PRINT"■ME ■"TC"■ POINTS."
10080 PRINT"■ANOTHER GAME Y/N?"
10090 GOSUB9500:IFA$="Y"THEN100
10100 IFA$<>"N"THEN10090
10110 END
```

(continued from previous page)

```
1700 GOTO 1670
1710 GOSUB 1830
1720 PRINT AT 8,0;"WELL DONE,PLEASE ENTER YOUR NAME";AT 10,3;"NO MORE THAN 20 LETTERS."
1730 INPUT N$(J)
1750 LET L(J)=S
1760 GOSUB 1830
1770 GOTO 1520
1780 FOR P=9 TO J STEP -1
1790 LET L(P+1)=L(P)
1800 LET N$(P+1)=N$(P)
1810 NEXT P
1820 RETURN
1830 FOR F=0 TO 23
1840 SCROLL
1850 PRINT TAB 31;
1860 NEXT F
1870 CLS
1880 RETURN
1890 SAVE "MU■"
1900 RUN
```

Fragg Chase

D R Gough,
Luton,
Bedfordshire.



FRAGG CHASE IS based on the popular game Zombies. At the start of the game your player is at the centre of the screen. A fragg will attack you.

To survive, the fraggs must be destroyed. To destroy fraggs you must lure them onto the red acid pools. For each fragg you destroy, 30,000 points will be awarded. The acid pools are not deadly to you, but 5,000 points will be lost for each character-sized acid pool you cross.

When all the fraggs are destroyed, or if there are more fraggs than you can handle, head for the edge of the screen. Reaching the edge is worth 30,000-50,000 points depending on how fast you were moving on arrival at the edge. When you reach the edge of the screen a new round will start with one more fragg than the previous round. Because fraggs are lazy, some of them do not materialise in every round. The maximum number of fraggs possible in each round is displayed at the bottom of the screen.

If a fragg destroys you, a new game will start. The highest score since the program was loaded is displayed at the top left of the screen.

The game will increase in speed after each round won. The maximum number of fraggs available is 40. If you find the game too easy, press the reset button and type:

POKE#2F71,#EA:POKE#2F72,
#EA:POKE#2F73,#EA:CALL#2F05

and press Return. The game will now be twice as fast.

The arrowed keys on either side of the space bar will move the player in the direction of the arrow.

1 Type in the program as listed.
2 Type Run and press Return.
3 If there are no error messages then replace

377B in line 10 with # 377C. Run the program again. If "Out of data in 10" appears on the screen then Goto paragraph 5.

4 If an error was logged in para 2, you have missed out some data statements in the program. If no error was logged in para 3, you have somehow typed in too much data.

5 Amend line 10 to read as per the listing and type:
CSAVE"FRAGG CHASE",A#2FC5,E#377B,S,AUTO

6 Start cassette machine recording, wait 10 seconds, press Return.

7 When program is saved type:
CLOAD"FRAGG CHASE",S,V; and press Return

8 Rewind cassette and press play. If any errors are reported then repeat from para 5.

```
10 FORN=#2F05TO#377E:READD:POKEN,D:NEXTN
100 DATA234,32,178,50,32,9,49,234,234,32,159,54,32,20
5,51,32,18,49,32
110 DATA1,48,234,32,178,50,32,167,50,32,30,55,234,234
,32,167,50,32,181,54
120 DATA32,159,54,32,20,48,32,45,51,234,32,79,49,32,2
16,52,234,234,32,135
130 DATA49,32,9,49,32,45,50,32,238,52,32,135,50,234,3
2,61,53,32,14,55
140 DATA169,1,141,79,2,141,78,2,234,234,32,131,51,32,
27,51,32,187,50,32
150 DATA155,51,32,53,52,234,32,9,51,32,172,53,234,234
,32,214,53,169,0,141
160 DATA108,2,32,131,51,32,27,51,32,187,50,32,155,51,
32,53,52,234,32,9
170 DATA51,32,172,53,234,234,32,62,55,32,46,55,32,108
,55,234,234,234,234,234
180 DATA234,234,173,12,151,201,1,208,6,32,103,52,76,3
8,47,234,234,234,162,0
190 DATA189,0,150,141,1,151,189,1,150,141,2,151,142,1
4,151,32,161,49,32,225
200 DATA49,173,152,49,141,220,47,173,153,49,141,221,4
7,169,42,205,83,187,208,5
210 DATA169,2,141,12,151,234,174,14,151,232,232,236,9
,151,208,200,173,12,151
220 DATA201,2,208,6,32,203,250,76,30,47,234,76,94,47,
169,127,141,12,2,169,0
230 DATA141,0,4,141,1,4,169,10,141,106,2,96,169,147,1
62,0,157,168,187,232
240 DATA224,240,208,248,162,0,157,152,188,232,224,240
,208,248,162,0,157,136,189
250 DATA232,224,240,208,248,162,0,157,120,190,232,224
,240,208,248,162,0,157,104
260 DATA191,232,224,120,208,248,169,22,162,3,157,72,1
88
265 DATA232,224,37,208,248,162,3
270 DATA157,112,188,232,224,37,208,248,162,3,157,152,
188,232,224,37,208,248,162
280 DATA3,157,192,188,232,224,37,208,248,162,3,157,23
2,188,232,224,37,208,248
290 DATA162,3,157,16,189,232,224,37,208,248,162,3,157
,56,189,232
300 DATA224,37,208,248,162,3,157,96,189,232,224,37,20
8,248,162,3,157,136
305 DATA189,232,224,37,208,248,162,3,157,176
310 DATA189,232,224,37,208,248,162,3,157,216,189,232,
224,37,208,248,162,3,157,0
320 DATA190,232,224,37,208,248,162,3,157,40,190,232,2
24,37,208,248,162,3,157,80
330 DATA190,232,224,37,208,248,162,3,157,120,190,232,
224,37,208,248,162,3,157
340 DATA160,190,232,224,37,208,248,162,3,157,200,190,
232,224,37,208,248,162,3
350 DATA157,240,190,232,224,37,208,248,162,3,157,24,1
91,232,224,37,208,240,96
360 DATA169,0,141,225,2,32,16,242,96,169,12,141,80,18
1,141,81,181,141,84,181
370 DATA141,89,181,141,92,181,169,18,141,82,181,141,8
5,181,141,86,181
380 DATA141,88,181,141,93,181,141,94,181,169,45,141,8
3,181,141,91
390 DATA181,169,0,141,87,181,169,63,141,90,181,169,51
,141,95,181,96,169,83,141
400 DATA212,187,141,230,187,169,67,141,213,187,141,23
1,187,169,79,141,214,187
410 DATA141,232,187,169,82,141,215,187,141,233,187,16
9
420 DATA69,141,216,187,141,234,187,169,72,141,227,187
,169,73,141,228,187,169,05
430 DATA141,229,187,96,162,140,142,0,151,32,161,49,32
,172,49,32,225
440 DATA49,169,150,141,171,188,174,0,151,202,208,233,
96,169
450 DATA168,141,152,47,167,107,141,153,49,96,32,16,50
,173,108,239,56,201,4,176
460 DATA2,105,4,56,201,38,144,5,233,34,76,185,49,141,
2,151,32,16,50,173
470 DATA109,239,56,201,5,176,2,105,5,56,201,24,144,5,
233,17,76,211,49,141
480 DATA1,151,96,173,1,151,162,39,24,109,1,151,176,18
,202,208,247,24,105,127
490 DATA176,16,24,109,2,151,176,16,141,152,49,96,238,
153,49,76,236,49,238,153
500 DATA49,76,244,49,238,153,49,76,250,49,174,3,151,1
72,4,151,140,176,49,200
510 DATA208,1,232,140,4,151,142,3,151,142,177,49,140,
202,49,142,203,49,96,32
520 DATA99,50,160,76,162,76,185,1,150,93,3,150,208,26
,185,0,150,93,2,150
530 DATA208,18,142,5,151,140,7,151,32,101,50,174,5,15
1,172,7,151,234,234,234
540 DATA202,202,234,234,208,214,136,136,234,234,208,2
08,96,162,80,142,8,151,32
550 DATA172,49,234,234,174,8,151,234,234,234,234,173,
1,151,157,254,149,173,2
560 DATA151,157,255,149,202,202,234,234,208,223,96,16
9
570 DATA13,141,80,150,169,20,141,81,150,96,234,234,23
4,234,234,141,220
580 DATA187,141,221,187,96,234,234,234,234,234,234,23
4,234
590 DATA234,162,12,32,124,247,162,20,142,128,187,96,1
69,7,141,225,2,32,16,242
600 DATA96,32,194,50,32,230,50,96,32,120,235,201,10,2
40,13,201,11,240,13,201
610 DATA9,240,13,201,8,240,13,96,238,80,150,96,206,80
,150,96,238,81,150,96
620 DATA206,81,150,96,173,80,150,141,1,151,173,81,150
,141,2,151,32,161,49,32
630 DATA225,49,173,152,49,141,82,150,173,153,49,141,8
3,150,234,234,234,234,96
640 DATA173,82,150,141,24,51,173,83,150,141,25,51,169
,42,141,171,188,96,173,82
650 DATA150,141,42,51,173,83,150,141,43,51,169,22,141
,171,188,96,169,20,162,0
660 DATA157,128,187,232,224,160,208,248,162,0,157,104
,191,232,224,240,208,248
670 DATA141,64,191,141,32,188,141,72,188,141,112,188,
141,152,188,141,192,188
680 DATA141,232,188,141,16,189,141,56,189,141,96,189,
141,136,189,141,176
690 DATA189,141,216,189,141,0,190,141,40,190,141,80,1
90,141,120,190,141,160
700 DATA190,141,200,190,141,240,190,141,24,191,96,173
,82,150,141,84,150,173,83
710 DATA150,141,85,150,96,169,195,141,80,150,169,189,
141,81,150,96,173,82,150
720 DATA141,168,51,173,83,150,141,169,51,173,171,188,
201,150,208,3,32,178,51,96
730 DATA32,181,250,173,84,150,141,24,51,141,82,150,17
3,85,150,141,25,51,141,83
740 DATA150,32,234,51,76,21,51,169,48,162,14,157,0,15
2,202,208,250,169,2,141,9
750 DATA151,96,234,234,234,234,234,234,234,234,234,23
4,234,234,234,173,221,187
760 DATA233,48,208,50,169,53,141,221,187,173,220,187,
233,48,208,44,169,57,141
770 DATA220,187,173,219,187,233,48,208,36,169,57,141,
219,187,173
780 DATA218,187,233,48,208,28,169,48,141,218,187,141,
219,187,32,151,50,76,205
790 DATA51,169,48,141,221,187,96,206,220,187,96,206,2
19,187,96,206,218,187,96
800 DATA173,82,150,141,66,52,173,83,150,141,67
810 DATA52,173,171,188,201,147,208,3,32,76,52,96,234,
234,234,173,84,150,141,82
820 DATA150,173,85,150,141,83,150,238,9,151,238,9,151
,32,140,52,76,175,54,162
830 DATA0,160,251,32,144,245,169,0,170,138,72,169,0,3
2,134,250,162,0,202,208
840 DATA253,104,170,232,224,0,208,237,169,5,162,252,3
2,144,245,96,173,220,187
850 DATA105,2,201,58,16,4,141,220,187,96,233,10,141,2
20,187,238,219,187,173,219
860 DATA187,201,58,16,1,96,169,48,234,234,141,219,187
,238,218,187,173,218,187
870 DATA201,58,16,1,96,169,58,141,218,187,96,173,152,
49,141,211,52,173,153,49
880 DATA141,212,52,76,69,54,169,43,141,83,189,76,12,5
3,162,7,189,0,152,157,217
890 DATA187,202,208,247,162,7,189,7,152,157,235,187,2
02,208,247,96
900 DATA234,234,234,234,234,189,0,150,141,1,151,189,1
,150,141
910 DATA2,151,32,161,49,32,225,49,174,11,151,76,193,5
2
920 DATA234,234,234,234,234,234,234,174,11,151,76,46,
54,234,234,234
930 DATA234,234,234,234,234,234,234,234,234,234,173
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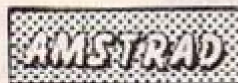
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 940 DATA82,150,141,58,53,234,234,234,173,83,150,141,5
9,53,234,234,234,169,42
 950 DATA141,0,0,96,169,14,141,145,191,141,185,191,141
,129,187,141,169,187,169
 960 DATA70,141,166,191,141,206,191,141,141,187,141,18
1
 970 DATA187,169,82,141,167,191,141,207,191,141,142,18
7,141,182,187,169,65,141
 980 DATA168,191,141,208,191,141,143,187,141,183,187,1
69,71,141,169,191,141,209
 990 DATA191,141,144,187,141,184,187,169,71,141,170,19
1,141,210
 1000 DATA191,141,145,187,141,185,187,169,39,141,171,1
91,169,83,141,172,191,141
 1010 DATA212,191,169,67,141,147,187,141,187,187,76,18
7
 1020 DATA54,234,234,96,173,9,151,24,74,74,141,184,53,
169,21,233,1,141,118,2
 1030 DATA173,118,2,201,0,208,249,96,234,234,234,173,8
3,150,141,212,53,234,234
 1040 DATA234,169,22,141,0,0,96,162,0,189,0,150,141,1,
151,189,1,150,141,2,151
 1050 DATA142,11,151,32,161,49,32,225,49,174,11,151,17
3,152,49,141,2,54,173,153
 1060 DATA49,141,3,54,76,181,54,169,22,141,83,189,189,
0,150,205,80,150,208,3
 1070 DATA76,22,54,16,2,48,38,222,0,150,189,1,150,205,
81,150,208,3,76,43,54
 1080 DATA16,2,48,26,222,1,150,234,234,234,76,239,52,1
74,11,151,232,232,236
 1090 DATA9,151,208,160,96,254,0,150,76,22,54,254,1,15
0,76,43,54,173,211,52
 1100 DATA141,82,54,173,212,52,141,83,54,173,83,189,23
4,201,150,208,9,32,225,250
 1110 DATA32,140,52,76,46,54,76,208,52,173,2,54,141,14
0,54,173,3,54,141,141,54
 1115 DATA234,234,234,234,234,234,234,234,234,234,234,
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 1120 DATA234,234,234,234,234,234,234,234,234,173,83,1
89,201,150
 1130 DATA208,4,234,76,49,54,76,255,53,216,53,234,234,
234,234,173,3,151,56,233
 1140 DATA192,176,5,169,192,141,3,151,96,234,234,169,1
,141,12,151,96,169,0,141
 1150 DATA12,151,96,169,72,141,148,187,141,188,187,169
,65,141,149,187,141,189
 1160 DATA187,169,83,141,150,187,141,190,187,169,69,14
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 1170 DATA234,234,173,9,151,56,233,20,176,15,173,9
 1180 DATA151,24,106,105,48,234,141,162,191,141
 1190 DATA202,191,96,173,9,151,24,106,238,161
 1200 DATA191,238,201,191,56,233,10,176,245,105
 1210 DATA58,141,162,191,141,202,191,96,169,47
 1220 DATA141,161,191,141,201,191,76,222,54,234
 1230 DATA234,234,234,234,169,48,162,7,157,0
 1240 DATA152,202,208,250,169,2,141,9,151,96
 1250 DATA162,7,189,235,187,157,7,152,202,208
 1260 DATA247,96,234,234,234,234,162,0,109,210
 1270 DATA187,56,253,236,187,144,27,189,218,187
 1280 DATA221,236,187,208,6,232,224,7,208,234
 1290 DATA96,162,7,189,217,187,157,235,187,202
 1300 DATA208,247,234,234,96,157,235,187,202,203
 1310 DATA247,96,162,7,189,217,187,157,0,152
 1320 DATA202,208,247,96,234,234,234,234
```

Destroyer

Philip Orr, Glengormley, Co. Antrim.



THIS PROGRAM uses either joystick or keyboard. You are the commander of a destroyer and you must destroy the enemy submarines. There are four submarines on the screen travelling at different speeds and worth different points.

sub 1 = 1 point.
sub 2 = 10 points.
sub 3 = 30 points.
sub 4 = 50 points.

There is also a time limit of three minutes in which you must get as many points as you can. To make matters worse underground bombers are constantly firing missiles up towards you. If one of these missiles hits you then you lose.

```
80 SYMBOL AFTER 128
90 FOR a=128 TO 148
100 READ b,c,d,e,f,g,h,i
110 SYMBOL a,b,c,d,e,f,g,h,i
120 NEXT
130 cloud$=CHR$(140)+CHR$(141)+CHR$(142)+CHR$(143)
140 clouds$=CHR$(144)+CHR$(145)+CHR$(146)+CHR$(147)
150 DATA 0,192,99,63,42,63,96,192,0,0,192,160,240,224,
0,0,0,0,3,5,15,7,0,0,0,3,198,252,84,252,6,3,0,0,3,6,15
,255,31,7
160 DATA 0,0,48,98,244,252,252,248,0,0,2,3,7,2,0,0,0,0
,32,192,197,44,0,0,13,31,29,46,60,31,15,3,120,224,224,
48,112,224,192,128
170 DATA 144,96,96,240,240,96,96,0,0,96,96,240,240,96,
96,144,0,1,3,7,55,127,127,255,199,239,223,191,255,255,
255,255,0,248,248,247,23
9,255,255,255,0,0,0,128,192,0,128,192
180 DATA 255,255,127,31,30,0,0,0,255,255,255,255,255,2
06,0,0,255,255,255,255,247,227,0,0,224,224,224,192,192
,128,0,0,0,0,0,0,204,255
,255,255
190 MODE 1:BORDER 0:INK 0,0:INK 1,18:INK 2,6:INK 3,18,
0:SPEED INK 5,5:BORDER 0:PAPER 0
200 LOCATE 15,1:PEN 1:PRINT "DESTROYER"
210 MOVE 220,300:DRAW 370,300
220 PEN 2:LOCATE 3,3:PRINT " You are the commander of
a subnarine   destroyer. It is your job to destroy the
enemy subs.":PRINT:PEN 1
230 PRINT " You cortrol the destroyer by either    usi
ng the joystick or the left and rightcursor keys. To d
rop the depth charges  p
ress the space bar or the FIRE button  on the Joystick
.":PRINT:PEN 2
240 PRINT " The further down the screen the Sub is the
 more points you get.":PRINT:PEN 1
250 PRINT " There is a time limit of 3 minutes in  whi
ch you must get the highest amount   of points you can
.":PRINT:PEN 2
260 LOCATE 13,21:PRINT "Good Luck!!!!!":PRINT:PEN 3
270 LOCATE 13,23:PRINT "PRESS ANY KEY"
280 A$=INKEY$: IF A$="" THEN 280
290 FOR a=1 TO 26:PRINT:NEXT
300 INK 0,1:INK 1,0:INK 2,24:INK 3,11:INK 4,12:INK 5,2
6:INK 6,6:INK 7,6,24:SPEED INK 10,10:MODE 0
310 PAPER 1:LOCATE 1,1:PRINT SPACE$(20)
320 PEN 2:LOCATE 1,1:PRINT "Score:";score
330 PAPER 3:FOR a=2 TO 9:LOCATE 1,a:PRINT SPACE$(20):N
EXT
340 PAPER 1:FOR a=23 TO 25:LOCATE 1,a:PRINT SPACE$(20)
;:NEXT
350 PLOT 23,40,5:DRAW 612,40:DRAW 612,10:DRAW 23,10:DR
AW 23,40
354 PAPER 0
355 LOCATE 1,22
356 FOR a=1 TO 20:PRINT CHR$(148);:NEXT
360 PEN 5:PAPER 3
370 RESTORE 430
380 FOR a=1 TO 6
390 READ b,c
400 LOCATE b,c:PRINT CHR$(22)+CHR$(1);cloud$
410 LOCATE b,c+1:PRINT clouds$+CHR$(22)+CHR$(0)
420 NEXT
425 PAPER 1
430 DATA 3,3,7,5,10,2,6,4,15,2,13,6
440 PEN 2:LOCATE 2,24:PRINT "Time:";:PAPER 6:PRINT "
 ";:PAPER 2:PRINT SPACE$(10):PAPER 1
450 xship=9:sub1=10:sub2=18:sub3=5:sub4=17:clock=300:b
=0:ybomb=9:arr=607:subomb=0:xbom=INT(RND*19)+2:ybom=21
:astic=0
460 sub1=sub1+0.5:sub2=sub2-1:sub3=sub3+1.2:sub4=sub4-
1.6:astic=astic+1
470 IF astic=5 THEN SOUND 1,50,10,5
480 IF astic=10 THEN SOUND 1,50,10,3:astic=0
490 GOSUB 930
500 LOCATE xship,9:PAPER 3:PEN 5:PRINT " ";CHR$(132);C
HR$(133);" "
510 PAPER 0:PEN 4
520 LOCATE sub1,12:PRINT " ";CHR$(128);CHR$(129)

530 LOCATE sub2,15:PRINT CHR$(130);CHR$(131);" "
540 LOCATE sub3,10:PRINT "  ";CHR$(128);CHR$(129)
550 IF subomb=1 THEN GOSUB 1050
560 LOCATE sub4,21:PRINT CHR$(130);CHR$(131);"  "
570 IF sub1>16 THEN LOCATE sub1,12:PRINT "    ":sub1=1
580 IF sub2<2 THEN LOCATE sub2,15:PRINT "    ":sub2=18

590 IF subomb=1 THEN GOSUB 1050
600 IF sub3>16 THEN LOCATE sub3,18:PRINT "    ":sub3=1
610 IF sub4<2 THEN LOCATE sub4,21:PRINT "    ":sub4=18

620 IF INT(RND*10)+1=5 AND subomb=0 THEN subomb=1
630 IF subomb=1 THEN GOSUB 1050
635 a$=INKEY$
640 IF JOY(0)=4 OR INKEY(8)=0 THEN xship=xship-1
650 IF JOY(0)=8 OR INKEY(1)=0 THEN xship=xship+1
660 IF JOY(0)=16 AND b=0 OR a$=" " AND b=0 THEN x=xshi
p+3:b-1
670 IF b=1 THEN GOSUB 710
680 IF xship=0 THEN xship=1
690 IF xship=18 THEN xship-17
```

```
700 GOTO 460
710 ybomb=ybcmb+1
720 PEN 4:LOCATE x.ybomb-1:PRINT " ":LOCATE x.ybomb:PR
INT CHR$(138)
730 IF ybomb=12 AND x>=sub1+1 AND x<=sub1+2.5 THEN GOS
UB 790
740 IF ybomb=15 AND x>=sub2 AND x<=sub2+1.8 THEN GOSUB
 790
750 IF ybomb=18 AND x>=sub3+1 AND x<=sub3+2.5 THEN GOS
UB 790
760 IF ybomb=21 AND x>=sub4 AND x<=sub4+2 THEN GOSUB 7
90
770 IF ybomb=21 AND x<>sub4 AND x<>sub4+2 THEN LOCATE
x,ybomb:PRINT " ":b=0:ybomb=9
780 RETURN
790 FOR a=1 TO 5
800 PEN 7:LOCATE x,ybomb:PRINT CHR$(134);CHR$(135)
810 IF a=1 OR a=3 THEN SOUND 3,0,15,6,0,0,2
820 PEN 7:LOCATE x,ybomb:PRINT CHR$(136);CHR$(137)
830 IF a=4 THEN SOUND 2.0,10,7,0,0,4
840 NEXT
850 LOCATE x,ybomb:PRINT "  ":
860 IF ybomb=12 THEN sub1=1:LOCATE 1,12:PRINT SPACE$(2
0);:score=score-1
870 IF ybomb=15 THEN sub2=16:LOCATE 1,15:PRINT SPACE$(
20);:score=score+10
880 IF ybomb=18 THEN sub3=1:LOCATE 1,18:PRINT SPACE$(2
0);:score=score+30
890 IF ybomb=21 THEN sub4=16:LOCATE 1,21:PRINT SPACE$(
20);:score=score+50
900 b=0:ybomb=9
910 PEN 2:PAPER 1:LOCATE 7,1:PRINT score:PAPER 0:PEN 4
920 RETURN
930 PLOT acc,32,1
940 DRAW acc,14
950 acc=acc-0.9
960 IF acc<192 THEN 980
970 RETURN
980 LOCATE 7,10:PEN 7:PAPER 0:PRINT "GAME OVER":FOR A=
1 TO 1000:NEXT
990 INK 8,24,6:LOCATE 3,20:PAPER 0:PEN 8:PRINT "Do you
 want another         game (y/n)     "
1000 a$=LOWER$(INKEY$)
1010 IF a$="" THEN GOTO 1000
1020 IF a$="y" THEN 290
1030 IF a$="n" THEN INK 0,0:BORDER 0:PAPER 0:INK 1,18:
PEN 1:MODE 1:END
1040 GOTO 1000
1050 LOCATE xbom,ybcm:PRINT " ":ybom=ybom-1:LOCATE xbo
m,ybom:PRINT CHR$(139)
1060 IF ybom=9 AND xbom>=xship+1 AND xbom<=xship+2 THE
N acc=191:GOSUB 1090:RETURN
1070 IF ybom=9 THEN LOCATE xbom,ybom:PAPER 3:PRINT " "
:PAPER 0:xbom=INT(RND*19)+2:ybom=21
1080 RETURN
1090 '
1100 FOR a=1 TO 10
1110 PEN 7:PAPER 3:LOCATE xship+1,9
1120 PRINT CHR$(134);CHR$(135)
1130 IF a=1 OR a=3 THEN SOUND 3,0,15,6,0,0,5
1140 LOCATE xship+1,9
1150 PRINT CHR$(136);CHR$(137)
1160 IF a=4 THEN SOUND 2,0,10,7,0,0,11
1170 NEXT
1180 LOCATE xship+1,9:PAPER 3:PRINT "  ":LOCATE xship+
1,8:PRINT "  ":PAPER 0
1185 score=0
1190 PEN 4:ybom=22:RETURN
```

Blackjack

David Potter,
Alton,
Hampshire.



HERE IS a program called Blackjack for the 32K BBC micro. This program allows the user to play the computer at a game of Pontoon. The aim of the game of course is to make your cards total 21 or as near that as possible, but without exceeding you bust.

You both start with £100 and when your first card is dealt you bet on it, and another one is dealt. You can then stick with what you have got by pressing the space bar, or twist to get another card by pressing the Return key or buy another card, thus increasing your stake, by pressing B. If you bust then the computer takes your bet.

When you stick the computer then has its go, and depending on the value of its cards you either win or lose that hand.

Blackjack program 1.

```
 10REM Blackjack (C) David Potter
 20*TV255
 30ENVELOPE2,1,0,0,0,0,0,0,10,0,0,-2,80,0
 40ENVELOPE3,1,2,-1,0,20,60,0,126,0,0,-126,126,0
 50ENVELOPE4.3.0.0.0.1.1.1.120.-5.-5.-10.120.90
 60VDU23,224,8,28,28,107,127,107,8,28
 70VDU23,225,8,28,62,127,62,28,8,0
 80VDU23,226,54,127,127,127,62,28,8,0
 90VDU23,227,8,28,62,127,127,127,28,62
100VDU23,228,1,3,7,15,31,63,127,255
110VDU23,229,128,192,224,240,248,252,254,255
120VDU23,230,255,127,63,31,15,7,3,1
130VDU23,231,255,254,252,248,240,224,192,128
140VDU23,232,0,0,15,15,63,63,63,63
150VDU23,233,0,0,60,60,255,255,255,255
160VDU23,234,63,63,15,15,3,3,0,0
170VDU23,235,255,255,252,252,240,240,192,192
180VDU23,236,0,0,3,3,3,3,63,63
190VDU23,237,192,192,240,240,240,240,255,255
200VDU23,238,63,63.60,60,0,0,3,3
210VDU23,239,255,255,207,207,192,192,240,240
220VDU23,242,255,255,255,255,15,15,63,63
230VDU23,243,252,252,252,252,192,192,240,240
240VDU23,244,1,1,3,3,7,15.63,255
250VDU23,245.128,128,192,192,224.240,252,255
260VDU23,246,255,63,15,7,3,3,1,1
270VDU23,247,255,252,240,224,192,192,128,128
280VDU23,248,3,3,15,15,63,63,255,255
290VDU23,249,0,0,192,192,240,240,252,252
300CHAIN"BLACKJACK2"
```

Blackjack program 2.

```
   10MODE1:DIMA$(20):GCOL0,3:MOVE0,0:DRAW0,1020:DRAW12
76,1020:DRAW1276,0:DRAW0,0:GCOL0,1:MOVE10,1010:DRAW126
6,1010:DRAW1266,914:DRAW10,914:DRAW10,1010
   20PROCD("Blackjack",464,992,3):PROCD("Blackjack",46
8,988,3):PROCD("Blackjack",472,984,1):PROCD("Bet=",832
,992,2):PROCD("Bet=",836,988,0):PROCD("Bet=",840,984,2
):PROCD("'",946,988,3)
   30MO$=CHR$8+CHR$8+CHR$10:DI$=CHR$228+CHR$229+MO$+CH
R$230+CHR$231:CL$=CHR$236+CHR$237+MO$+CHR$238+CHR$239:
SP$=CHR$248+CHR$249+MO$+CHR$242+CHR$243:HE$=CHR$232+CH
R$233+MO$+CHR$234+CHR$235
   40CR1%=100:CR2%=100:COLOUR2:PRINTTAB(1,1)"ME..";:CO
LOUR3:PRINT''100.00":COLOUR2:PRINTTAB(1,2)"YOU.";:COLO
UR3:PRINT''100.00"
   50ST%=0:PROCST:VDU28,1,30,38,4:CLS:VDU28,2,30,37,28
:@%=&20209
   60GCOL0,1:MOVE60,30:DRAW60,120:DRAW1220,120:DRAW122
0,30:DRAW60,30:GCOL0,3:MOVE448,916:DRAW448,1006:MOVE83
2,916:DRAW832,1006:PROCD("Your Hand:",64,892,2):AA=0:U
=0:V=0:A=0:X=2:V2=0:PROCDEAL:V=V+1:A=A+J:PROCD("My Han
d:",64,510,2)
   70PROCSQ(96,160,1)
   80VDU4:CLS:COLOUR3:PRINT'" Please Input Your stake:
";:INPUT" ''ST%:IF ST%>CR1% THEN COLOUR1:CLS:SOUND3,3,
10,10:PRINT'" Stake larger than credit try again":TIME
=0:REPEATUNTILTIME>250:GOTO80
   90IF ST%<=0 THEN COLOUR1:CLS:SOUND3,3,10,10:PRINT'"
 Oh come on chicken!":TIME=0:REPEATUNTILTIME>200:GOTO8
0
  100PROCST:CR1%=CR1%-ST%:PROCSC:PROCDEAL:V=V+1:A=A+J:
PROCSQ(320,160,1):VDU4:CLS:GOTO320
  110DEFPROCDEAL
  120J=INT((RND(1)*13))+1:OJ=J
  130IF J=1 W$="A":GOTO160
  140IF J=11 W$="J":J=J-1:GOTO180
  150IF J=12 W$="Q":J=J-2:GOTO180
  160IF J=13 W$="K":J=J-3:GOTO180
  170W$=STR$(J)
  180K=INT(RND(1)*4)+1
  190IF K=1 R$="S"
  200IF K=2 R$="H"
  210IF K=3 R$="D"
  220IF K=4 R$="C"
  230L=-1:REPEAT:L=L+1:IF W$+R$=A$(L) THEN120
  240UNTIL L=U
  250U=U+1:A$(U)=W$+R$
  260IF X=1 YY%=160 ELSE YY%=544
  270PROCCARD((V*224)+96,YY%)
  280IF W$="A" THEN ON X GOTO 300,290 ELSE ENDPROC
  290VDU4:CLS:COLOUR3:INPUT " Amount For Ace",G:IF G<>
1 AND G<>11 COLOUR1:CLS:SOUND3,3,10,10:PRINT'" Either
1 Or 11!":TIME=0:REPEATUNTILTIME>200:GOTO290 ELSE J=G:
CLS:VDU5:ENDPROC
  300IF (AA+11)<=21 THEN J=11 ELSE J=1
  310ENDPROC
```

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```
  320IF A>21 THEN 400
  330IFV=5 THEN 370
  340VDU4:CLS:COLOUR3:PRINT'" Command:":A$=GET$:VDU5
  350IF A$=CHR$13 THEN 360 ELSE IF A$=" " THEN 370 ELS
E IF A$="B" PROCBUY ELSE 340
  360PROCDEAL:A=A+J:V=V+1:GOTO320
  370VDU4:CLS:COLOUR3:PRINT'" MY TURN":VDU5
  380V2=V:V=0
  390X=1:PROCDEAL:AA=AA+J:V=V+1:IF AA<17 AND V<5 THEN
390
  400VDU4,28,2,30,37,28:CLS:@%=10:COLOUR2:PRINT" I Sco
red...";AA:COLOUR3:PRINT" You Scored.";A:@%=&20209
  410IF AA>21 COLOUR2:PRINTTAB(15,0)"I Bust":WI=1
  420IF A>21 COLOUR3:PRINTTAB(15,1)"You Bust":WI=2
  430IF V2<5 AND V<5 AND AA<21 AND A<21 THEN 440 ELSE
450
  440IF A>AA COLOUR3:PRINTTAB(15,1)"You Win":WI=1:GOTO
 510 ELSE COLOUR2:PRINTTAB(15,0)"I Win":WI=2:GOTO510
  450IF AA=21 AND V=2 COLOUR2:PRINTTAB(15,0)"Blackjack
.I Win":CR2%=CR2%+ST%:WI=2:GOTO 510
  460IF A=21 AND V2=2 COLOUR3:PRINTTAB(15,1)"Blackjack
.You Win":CR1%=CR1%+ST%:WI=1:GOTO 510
  470IF AA<22 AND V=5 AND AA>0 COLOUR2:PRINTTAB(15,0)"
5 Card Trick.I Win":WI=2:GOTO 510
  480IF A<22 AND V2=5 COLOUR3:PRINTTAB(15,1)"5 Card Tr
ick.You Win":WI=1:GOTO 510
  490IF AA=21 COLOUR2:PRINTTAB(15,0)"Pontoon.I Win":WI
=2:GOTO510
  500IF A=21 COLOUR3:PRINTTAB(15,1)"Pontoon.You Win":W
I=1
  510IF WI=1 THEN SOUND1,4,80,30:CR1%=CR1%+(ST%*2):CR2
%=CR2%-ST% ELSE CR2%=CR2%+ST%:FORI=40TO0STEP 4:SOUND3,
3,I,2:NEXT
  520PROCSC
  530IF CR1%=0 OR CR2%=0 VDU28,1,26,38,4:CLS:GOTO540 E
LSE 570
  540IF CR1%=0 THEN PROCD("You Lose Turkey!",352,736,2
) ELSE PROCD("OK You Win This Time Sucker!",160,736,2)
  550PROCD("For Another Round Of Blackjack,",112,608,1
):PROCD("Press The Space Bar.",288,516,1)
  560REPEAT:B$=GET$:UNTILB$=" ":VDU28,0,31,39,0:GOTO40
  570VDU28,1,17,38,16:CLS:PROCD("Press Space For Anoth
er Hand.",144,512,1):REPEAT:B$=GET$:UNTILB$=" ":VDU4:G
OTO50
  580DEFPROCCARD(X%,Y%):PROCSQ(X%,Y%,3):ON K GOTO 590,
600,610,620
  590GCOL0,0:CO%=0:MOVEX%,Y%+192:VDU227:MOVEX%+162,Y%+
64:VDU227:CE$=SP$:PROCM:ENDPROC
  600GCOL0,1:CO%=1:MOVEX%,Y%+192:VDU226:MOVEX%+162,Y%+
64:VDU226:CE$=HE$:PROCM:ENDPROC
  610GCOL0,1:CO%=1:MOVEX%,Y%+192:VDU225:MOVEX%+162,Y%+
64:VDU225:CE$=DI$:PROCM:ENDPROC
  620GCOL0,0:CO%=0:MOVEX%,Y%+192:VDU224:MOVEX%+162,Y%+
64:VDU224:CE$=CL$:PROCM:ENDPROC
  630DEFPROCM:MOVEX%+130,Y%-96:J$=STR$(OJ):IF LEN(J$)=
1 OR OJ>10 VDU9
  640IF OJ>1 AND OJ<11 THEN PRINT;J$ ELSE PRINT;W$
  650MOVEX%,Y%+224:IF OJ>1 AND OJ<11 THEN PRINT;J$ ELS
E PRINT;W$
  660IF OJ>1 AND OJ<11 THEN PROCD(J$,X%+32,Y%+160,CO%)
 ELSE IF OJ<>1 PROCD(W$,X%+32,Y%+160,CO%)
  670IF OJ=1 MOVEX%+64,Y%+160:PRINTCE$
  680ENDPROC
  690DEFPROCSQ(X%,Y%,COL):GCOL0,COL:MOVEX%,Y%:MOVEX%+1
92,Y%:PLOT85,X%+192,Y%+256:MOVEX%,Y%+256:PLOT85,X%,Y%:
VDU5:GCOL0,0:MOVEX%,Y%+30:VDU245:MOVEX%+164,Y%+30:VDU2
44:MOVEX%+164,Y%+256:VDU246:MOVEX%,Y%+256:VDU247:SOUND
0,2,4,1:SOUND0,0,0,0:ENDPROC
  700DEFPROCST:VDU28,32,2,38,1:CLS:IF ST%=0 PROCD("0.0
0",1024,988,3):GOTO720
  710ST$=STR$(ST%):PROCD(ST$,1008,988,3):AL=LEN(ST$)*3
2:PROCD(".00",AL+1024,988,3)
  720VDU28,2,30,37,28:ENDPROC
  730DEFPROCSC:VDU28,0,31,39,0:COLOUR3:IF CR2%<=0 CR2%
=0:COLOUR1
  740PRINTTAB(6,1);CR2%;"  ":COLOUR3:IF CR1%<=0 CR1%=0
:COLOUR1
  750PRINTTAB(6,2);CR1%;"  ":COLOUR3:VDU28,2,30,37,28:
ENDPROC
  760DEFPROCBUY
  770VDU4:COLOUR2:CLS:PRINT'" How much do you want to
pay ?";:INPUT" '"BU%:IF BU%>CR1% THEN COLOUR1:CLS:SOUN
D3,3,10,10:PRINT'" Too much try again!":TIME=0:REPEATU
NTILTIME>200:CLS:GOTO770
  780ST%=ST%+BU%:CR1%=CR1%-BU%:PROCST:PROCSC:CLS:ENDPR
OC
  790DEFPROCD(A$,K,L,CO)
  800GCOL0,CO:LOCAL N:A%=&A:X%=0:Y%=&A:D=&A00:IF LEN(A
$)=1 K=K+16
  810FORN=1 TO LEN(A$):B$=MID$(A$,N,1):?D=ASC(B$):CALL
 (&FFF1):VDU23,240,D?1,D?1,D?2,D?2,D?3,D?3,D?4,D?4,23,
241,D?5,D?5,D?6,D?6,D?7,D?7,D?8,D?8:VDU5:MOVEK+(N*32),
L:VDU240:MOVEK+(N*32),L-32:VDU241:NEXT N:VDU4:ENDPROC
```

Utilities

T S Wharton,
County Durham.

VIC-20

THIS IS A LOADER program for three machine-code routines which are as follows:

■ A cassette motor switch: this switches the cassette motor on so that tapes can be rewound or fast forwarded while you are using the keyboard to program or a program is running.

The relevant Data statements are in lines 40-50. After running type:

SYS 673

F1 Key will now switch the cassette motor on

F3 Key will switch it off.

To kill this routine press Run Stop/Restore.

■ Random character colour: this brightens the screen up when you are typing by changing the colour of each character as you type. The cursor also flashes different colours. It does not print a character the same colour as the screen so all characters should be visible whichever screen colour you use. It also adds colour to the listings.

The relevant Data statements are in lines 70-80. After running type:

SYS 673

To kill this routines pres Run Stop/Restore.

■ Clear screen: this routine enables you to clear areas of the screen and leave the rest intact

SYS 673 clears the top half of the screen. As it is it clears the top eleven lines. To change the number of lines Poke 674, X where X is a number between 0-22. This clears X+1 lines.

SYS 678 clears the bottom half of the screen. The routine will clear the bottom twelve lines. To change this Poke 685 to a number between 0-21. This routine can also be used to clear the middle to the screen by poking a number between 0-22 to location 679 which is greater than that in location 685.

SYS 691 clears the left eleven columns of the screen. To change the number of columns Poke 694 with a number between 0-21.

SYS 704 clears the right eleven columns. To change Poke 724 with a number between 0-20.

To use the routines type in the loader and the relevant data statements for the routine you want. The first two will not run together. The third can be used with the other two if it is loaded into a different area of memory as long as the call addresses to the routines are changed to the new memory area.

Vic utilities

```
10 G=673
20 READA:IFA=999THENEND
30 POKEG,A:G=G+1:GOTO20
39 REM***CASSETTE MOTOR SWITCH
40 DATA120,169,174,141,20,3,169,2,141,21,3,88,96,165,197,201,39,240,7,201,47,240
,22,76
41 DATA191,234,173,17,145,9,64,141,17,145,173,28,145,41,12,141,28,145,76,191,234
,159,254
42 DATA141,28,145,169,62,141,17,145,76,191,234
50 DATA999

69 REM***RANDOM CHARACTER COLOUR
70 DATA120,169,174,141,20,3,169,2,141,21,3,88,96,169,0,141,27,145,173,24,145,77,
20,145
71 DATA14,7,133,254,173,13,144,74,74,74,74,41,7,197,254,208,14,56,42,41,7,201,7,
208,3
72 DATA10,41,7,24,133,254,165,254,141,134,2,76,191,234
80 DATA999

85 REM***CLEAR SCREEN
86 :
87 :
89 REM***TOP
90 DATA162,10,76,123,229
99 REM***BOTTOM
100 DATA162,22,32,141,234,202,224,10,208,248,76,129,229
109 REM***LEFT
110 DATA162,22,160,10,32,143,234,202,16,248,76,129,229
119 REM***RIGHT
120 DATA162,22,160,21,32,126,234,32,178,234,169,32,145,209,169,1,145,243,136,152
121 DATA10,208,237,202,16,232,76,129,229
125 DATA999
```

Tape Index

Terence Brown,
Ponteland,
Newcastle upon Tyne.



THIS PROGRAM creates a file of the cassettes contents and should normally be saved at the beginning of side 1. It may be used for either the 16K or 48K Spectrum. After entering the program, Run. You will then be asked to enter the Tape Title after which the menu is given providing options to:

1. Print Contents of data memory.
2. LPrint Contents of data memory.
3. Enter new data into memory.
4. Change existing data memory.
5. Save program and data memory.
6. Stop program.

After the program has been saved any future Load will result in it auto starting at option 1.

When entering Data there is no need to enter the data in order as the program contains a Sort subroutine — lines 900 to 930 — which will sort into order of, first, side and then tape counter.

For those who do not yet know how to enter line 0, enter this line as line 1 and after that Enter as a direct command

POKE 23756,0

Line 1 will now be changed to line 0.

The data memory has been dimensioned as 18 because this fills one screen without being asked "scroll?" and this is usually sufficient for most computer tapes. However, if additional data memory is required then alter the value of "y" in line 10.

If you Break the program for any reason do not type Run as this will clear all variables/strings. Restart by entering

GOTO 40

However, once the program has been used it may be reused on another tape by breaking the program — option 6 — then press Run to clear the memory for new data.

```
  0 REM ** TAPE INDEX
     ©    TERRY BROWN
 10 LET y=18: DIM w(y): DIM c$(
y,4): DIM p$(y,10): DIM d$(1): D
IM e$(3): FOR n=1 TO y: LET w(n)
=n: NEXT n
 20 INPUT AT 0,0;"TAPE TITLE  "
; LINE t$
 25 IF LEN t$>32 THEN GO TO 20
 30 LET c$(1)="1000": LET p$(1)
="DTS  INDEX"
 40 BORDER 7: PAPER 7: INK 0: B
RIGHT 0: CLS
 50 PRINT AT 0,8;"
  ";AT 1,8;" CONTENTS INDEX ";A
T 2,8;"
 60 PRINT '''"OPTIONS AVAILABLE"
''''   1 >>  PRINT CONTENTS''''
 2 >>  LPRINT CONTENTS''''   3 >>
  ENTER NEW DATA''''   4 >>  CHAN
GE DATA''''   5 >>  SAVE''''   6 >
>  STOP"
 70 INPUT AT 0,0;"ENTER OPTION
NUMBER   "; LINE z$: IF z$<"1" O
R z$>"6" THEN GO TO 70
 80 GO TO VAL z$*100
100 BORDER 7: PAPER 7: INK 0: B
RIGHT 1: CLS
110 PRINT PAPER 2; INK 7;AT 0,I
NT ((32-LEN t$)/2);t$: GO SUB 70
0: INPUT AT 0,0;"PRESS ENTER  ";
 LINE a$: GO TO 40
200 LPRINT INVERSE 1;AT 0,INT (
(32-LEN t$)/2);t$: LPRINT
210 LPRINT AT 2,0;"SIDE";AT 2,6
;"COUNT";AT 2,19;"PROGRAM TITLE"
220 LPRINT : FOR n=1 TO y
230 IF c$(w(n))<>"    " THEN LP
RINT TAB 2;c$(w(n),1);TAB 7;c$(w
(n),2 TO );TAB 20;p$(w(n))
240 NEXT n: GO TO 40
300 CLS : PRINT AT 1,7;"ENTERIN
G NEW DATA": FOR n=1 TO y
310 IF c$(w(n))="    " THEN GO
SUB 800: GO SUB 820: INPUT AT 0,
0;"DO YOU WISH TO ENTER ANOTHER
? "; LINE a$: IF a$(1)="n" OR a
$(1)="N" THEN GO TO 900
320 NEXT n: PRINT AT 6,16;"MEMO
RY FULL": PAUSE 200: GO TO 900
400 CLS : PRINT AT 0,9;"CHANGIN
G DATA": GO SUB 700
410 INPUT AT 0,0;"ENTER 'SIDE'
and 'COUNT' OF ITEMTO BE CHANGED
 "; LINE d$;"   "; LINE e$
420 FOR n=1 TO y
430 IF c$(w(n))=d$+e$ THEN CLS
: PRINT AT 0,9;"CHANGING DATA":
GO SUB 800: PRINT AT 4,17;c$(w(n
),1);AT 6,17;c$(w(n),2 TO );AT 8
,17;p$(w(n)): GO SUB 820: INPUT
AT 0,0;"DO YOU WISH TO CHANGE AN
OTHER ? "; LINE a$: IF a$(1)="n"
 OR a$(1)="N" THEN GO TO 900
440 NEXT n: GO TO 400
500 CLS : PRINT AT 10,5;"REWIND
 TAPE TO RECORD": SAVE "DTS  IND
EX" LINE 100: CLS : PRINT AT 6,3
;"THIS PROGRAM HAS BEEN SAVED";A
T 10,12;"TO VERIFY";AT 14,6;"REW
IND TAPE AND PLAY": VERIFY "DTS
 INDEX": GO TO 40
600 STOP
700 PRINT AT 2,0;"SIDE";AT 2,6;
"COUNT";AT 2,19;"PROGRAM TITLE"
710 PRINT : FOR n=1 TO y
720 IF c$(w(n))<>"    " THEN PR
INT TAB 2;c$(w(n),1);TAB 7;c$(w(
n),2 TO );TAB 20;p$(w(n))
730 NEXT n: RETURN
800 PRINT AT 4,8;"SIDE  :  ";AT
6,8;"COUNT  :  ";AT 8,8;"PROGRAM
 : ": RETURN
820 INPUT AT 0,0;"ENTER  SIDE
 "; LINE d$: PRINT AT 4,17;d$
830 INPUT AT 0,0;"ENTER  COUNT
 "; LINE e$: PRINT AT 6,17;e$
840 INPUT AT 0,0;"ENTER  PROGRA
M  "; LINE p$(w(n)): PRINT AT 8
,17;p$(w(n)): LET c$(w(n))=d$+e$
850 INPUT AT 0,0;"ARE DETAILS C
ORRECT ? "; LINE a$: IF a$(1)="n
" OR a$(1)="N" THEN GO TO 820
860 PRINT AT 4,17;"  ";AT 6,17;"
   ";AT 8,17;"           ": RETUR
N
900 FOR k=1 TO y-1: LET t=0: FO
R j=k+1 TO y
910 IF c$(w(j))<c$(w(k)) THEN L
ET x=w(j): LET w(j)=w(k): LET w(
k)=x: LET t=1
920 NEXT j: IF t=0 THEN GO TO 1
00
930 NEXT k: GO TO 100
```

```
0  REM ***  PRINT <--> LPRINT  ***
1  REM ***  HALLDOR ROSSEBO  ***
2  REM ***     3/8/84       ***
3  REM
10  FORN=38800TO38888
20  READ DTA$
30  DTA=VAL("#"+DTA$)
40  ER=ER+DTA
50  POKEN,DTA
60  NEXT
70  IFER<>10322THENPRINT"DATA ERROR":STOP
80  PRINT"DATA OK. "
90  PRINT:PRINT"PRESS A KEY TO CSAVE"
95  GETA$:CSAVE"P-LP",A38800,E38888
100  DATAA0,FF,A9,00,85,01,A9,04,85
110  DATA02,A5,00,C9,BA,D0,07,AA,A9
120  DATA8F,85,00,D0,06,A9,BA,85,00
130  DATAA2,8F,A9,00,85,03,C8,D0,02
140  DATAE6,02,B1,01,C9,00,D0,09,E6
150  DATA03,A9,03,C5,03,D0,ED,60,85
160  DATA04,A5,03,C9,00,F0,11,C8,D0
170  DATA02,E6,02,E6,03,A5,03,C9,05
180  DATA90,F3,B1,01,BC,02,A5,04,C5
190  DATA0C,D0,C9,8A,91,01,D0,C4
```

Print to LPrint

Halldor Rossebo,
Norway.



THIS MACHINE-CODE program replaces all Prints in a Basic program with LPrints, and vice versa. It was written on an Oric-1 48K, but it will also work on the 16K Atmos. The machine-code is fully relocatable.

To get the machine-code going call 38800. If you then list your Basic program you'll see that all the prints have been changed to LPrint. Another call will change them back.

The switch is located in (#)0, and other values then #BA here will make the program convert Prints to LPrints.

Catalogue

A D Oliver,
Dobwalls,
Cornwall.



THIS PROGRAM allows you to make a catalogue of programs stored on cassette. The program, written in position-independent code, was originally designed for Rom, but will reside anywhere in Ram.

On execution you are asked if you require a printout. Typing any other key than Y will just put a printout to the screen. To hold the present information on the screen, just turn off the tape deck.

To exit from the program you must press the reset button. ■

```
10 REM HEXLOADER - ENTER THE
20 REM STRING OF HEX DIGITS FIRST
30 REM AND THEN THE CHECKSUM
40 PRINT "ENTER START ADDRESS ";:INPUT START
50 PRINT "ENTER FINISH ADDRESS";:INPUT FINISH
60 FOR N = START TO FINISH STEP 8
65 PRINT N;": ";
70 TT=0:INPUT A$:Z=0
80 FOR S=1 TO LEN(A$) STEP 2
90 P=VAL("&H"+MID$(A$,S,2))
100 TT=TT+P:POKE (N+Z),P
110 Z=Z+1:NEXT
120 PRINT " = ";
130 INPUT T$
150 IF VAL(T$)<>TT THEN PRINT "ERROR - ENTER LINE AGAI
N":GOTO 70
160 NEXT

24576 : 17 01 22 30 BC 09 A6 80  =  519
24584 : 27 18 BD 80 0C 20 F7 0D  =  684
24592 : 0D 55 53 45 20 50 52 49  =  517
24600 : 4E 54 45 52 20 39 2F 6E  =  591
24608 : 20 00 BD 80 09 BC 80 06  =  631
24616 : 27 F8 81 59 27 0E 8E 01  =  698
24624 : 60 BF 02 05 17 00 EE 20  =  537
24632 : 09 8E 80 0F BF 02 05 17  =  515
24640 : 00 E3 30 8C 04 8D 35 20  =  645
24648 : 3C 0D 0D 46 49 4C 45 4E  =  452
24656 : 41 4D 45 20 20 20 20 42  =  485
24664 : 4C 48 53 20 20 20 45 52  =  481
24672 : 52 53 0D 3D 3D 3D 3D 3D  =  433
24680 : 3D 3D 3D 3D 3D 3D 3D 3D  =  488
24688 : 3D 3D 3D 3D 3D 3D 3D 3D  =  488
24696 : 3D 3D 0D 00 A6 80 27 04  =  472
24704 : 8D 19 20 FB 39 8D 12 B6  =  854
24712 : 00 7C 26 46 8E 06 00 5F  =  475
24720 : A6 85 8D 07 5C C1 03 25  =  777
24728 : F7 20 EA 8D 00 0C A0 9F  = 1174
24736 : 02 05 39 7F 02 02 7F 02  =  324
24744 : 03 8E 06 00 EF 00 7E AD  =  641
24752 : 9F A0 04 AD 9F A0 B6 26  =  859
24760 : 10 B6 00 7C 27 C6 20 C4  =  798
24768 : B6 02 02 4C E7 02 02 20  =  481
24776 : EA B6 02 03 4C B7 02 03  =  685
24784 : 20 E1 ED 46 E6 08 B7 02  =  795
24792 : 01 4F F6 02 02 ED 2C 83  =  654
24800 : 30 CB 30 1E E9 8D B4 1E  =  817
24808 : 09 8D E0 ED 2D 86 00 B7  =  965
24816 : 02 01 4F F6 02 03 ED 13  =  493
24824 : 08 30 CB 30 1E E9 8D 98  =  701
24832 : 1E 89 8D 97 86 0D 8D 93  =  394
24840 : 16 FF 7A 58 49 81 0A 25  =  736
24848 : 03 80 0A 5C 7A 02 01 26  =  396
24856 : F2 39 86 20 C6 05 17 FF  =  746
24864 : 7A 5A 26 FA 39 BE 04 00  =  703
24872 : BF 00 0D 86 60 A7 80 8C  =  992
24880 : 06 00 26 F9 39  -  350
```

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Simon Rollins completes the updated version of the YC index. The first digit after the reference refers to the volume number, the second to issue number and the third to the page.

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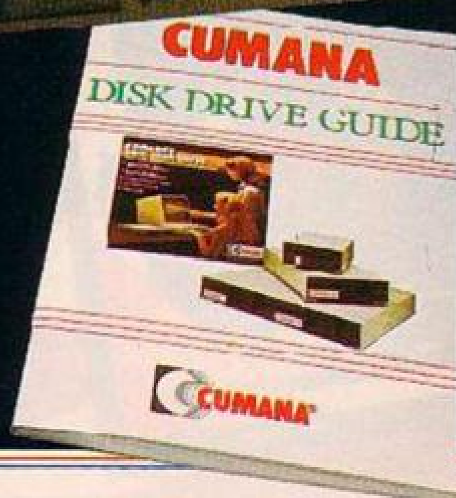
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FUNCTIONS

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CHAR$ number to 2 characters
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DEC hexadecimal to decimal
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INSTRING string search
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MEMORY$ all of memory as a string
MOD modulus
NUMBER 2 characters to number
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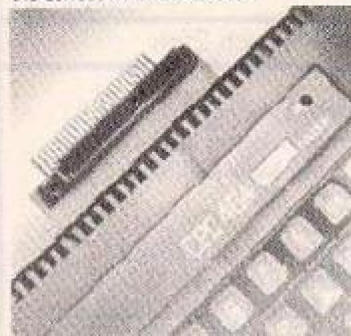
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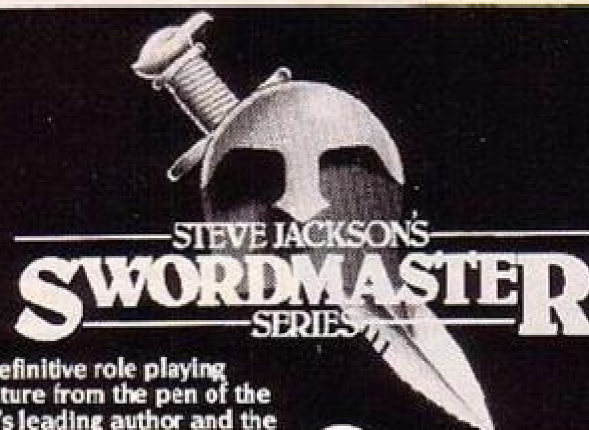
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DATEBASE

Local, national and international micro events are updated here. To publicise your event, phone Paul Bond on 01-661 3472.

Scottish Computer Show and Conference

Takes place March 12-14 at the Anderston Centre The Albany Hotel and the Holiday Inn, Glasgow. Trade Show, covering the big boys as well as home micros. Tickets are readily available from Cahners Exhibitions Ltd. Telephone 061-832 4242.

Computer courses

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Jack Tramiel makes a few pointed remarks about his former company, Commodore, whilst simultaneously indicating the direction he expects Atari profits to take now that he is in charge.

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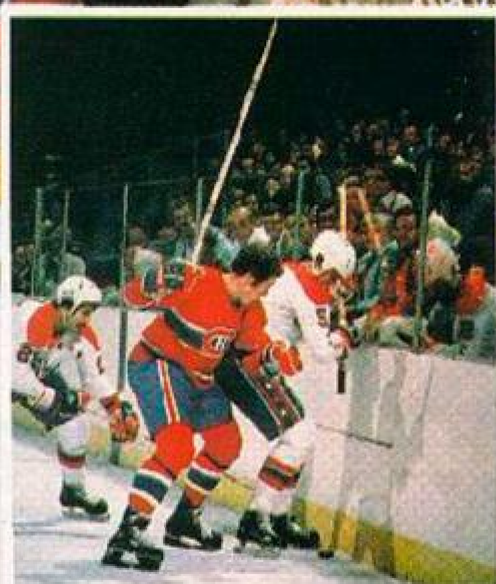
INFO takes place from March 26-28 at Olympia London. Open to the public. Some micros but mostly big stuff. Telephone BED Exhibitions, Wallington, Surrey 01 647 1001 for more details.

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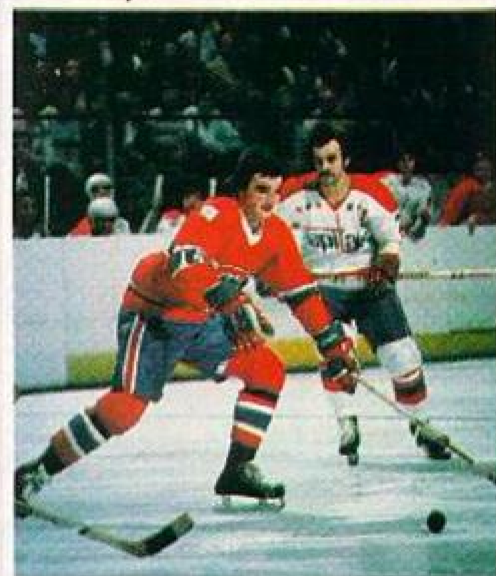
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